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Magazine

DECEMBER 1948

WAGING WAR ON OLD MAN WINTER

Michigan Highway Department crew attacks heavy drift with rotary plow

VOLUME 53 • NUMBER 12

NEW YORK • LONDON

More footage Drilled

...less upkeep cost

When you protect drills from rust and wear with Texaco Rock Drill Lubricants EP

YOU take rust and wear out of the category of major "headaches" when you protect your drills with *Texaco Rock Drill Lubricants EP*. At the same time, you assure more trouble-free operation (which means more footage per shift) . . . longer drill life . . . lower maintenance costs.

Texaco Rock Drill Lubricants EP have the "extreme pressure" characteristics necessary to protect moving parts against wear under the severest conditions. Furthermore, they resist washoff . . . stay fluid at low temperatures . . . keep parts free of gum and carbon formations . . . and guard against rust whether drills are running or idle.

Texaco Rock Drill Lubricants EP meet the specifications of leading rock drill manufacturers. Use the viscosities recommended for your particular drills and operating conditions.

For greater efficiency in *compressor* operation . . . for free rings, clean valves, clear airlines . . . use the recommended *Texaco Cetus, Alcaid or Algol Oils.*

Let a Texaco Lubrication Engineer help you increase drilling efficiency and economy. Call the nearest of the more than 2300 Texaco Wholesale Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.

TEXACO

REG. T.M.

TEXACO Lubricants

FOR ALL AIR COMPRESSORS AND TOOLS

Tune in . . . TEXACO STAR THEATRE presents MILTON BERLE every Wednesday night. METROPOLITAN OPERA broadcasts every Saturday afternoon.

WHY Clean Intake Filters More Than Once A Year?

YOU DON'T NEED TO WITH STAYNEW!!!

"When I first started as a maintenance engineer . . . more years ago than I like to admit . . . I found out for what long periods Staynew Intake Filters operate before cleaning is necessary.

"What's more, I found out that the high initial efficiency of Staynew Filters actually increases with use, because dust accumulates on the fins and forms a filter-aid of the very material being handled!"

Efficient Operation Up To 20 Months Reported By STAYNEW Users

TEXAS OIL OPERATOR:

"Conditions severe, but Staynew filters require cleaning only once every 15 months."

PENNSYLVANIA STEEL MILL:

"Staynew filters cleaned every 12 months."

MID-WEST CONCERN:

"Staynews throughout plant —average cleaning period, 18 months."

WEST COAST MANUFACTURER:

"Staynew intake filters operating at maximum efficiency after 20 months continuous service."

Model KE

Model C

Model D

Model DS

Model IDR

Models F and G

And When Staynews Do Require Cleaning...IT'S A CINCH!

These Staynew Intake Filters are dry type. There are no moving parts, no liquids, no reservoirs to be re-charged. They can be cleaned in just a few minutes by either vacuum or washing.

6 Models From 5 to 16,000 CFM

All Feature Original Radial Fin Design, Providing Maximum Filtering Area in Smallest Possible Space.

Model KE For small capacity use where weather housing is not required.

Model C Original *Protectomotor* design. For small capacity use where weather housing is required.

Model D The standard for heavy duty intake service on large engines and compressors.

Model DS Similar to Model D with the addition of a silencing chamber.

Model IDR Has the convenience of ground level installation plus the advantage of high level air intake.

Models F and G Low cost units for medium intake sizes.

IN CANADA: TORONTO McCARTHY AND ROBINSON ★ MONTREAL ENGINEERING EQUIPMENT CO.

COMPLETE DETAILS ON REQUEST

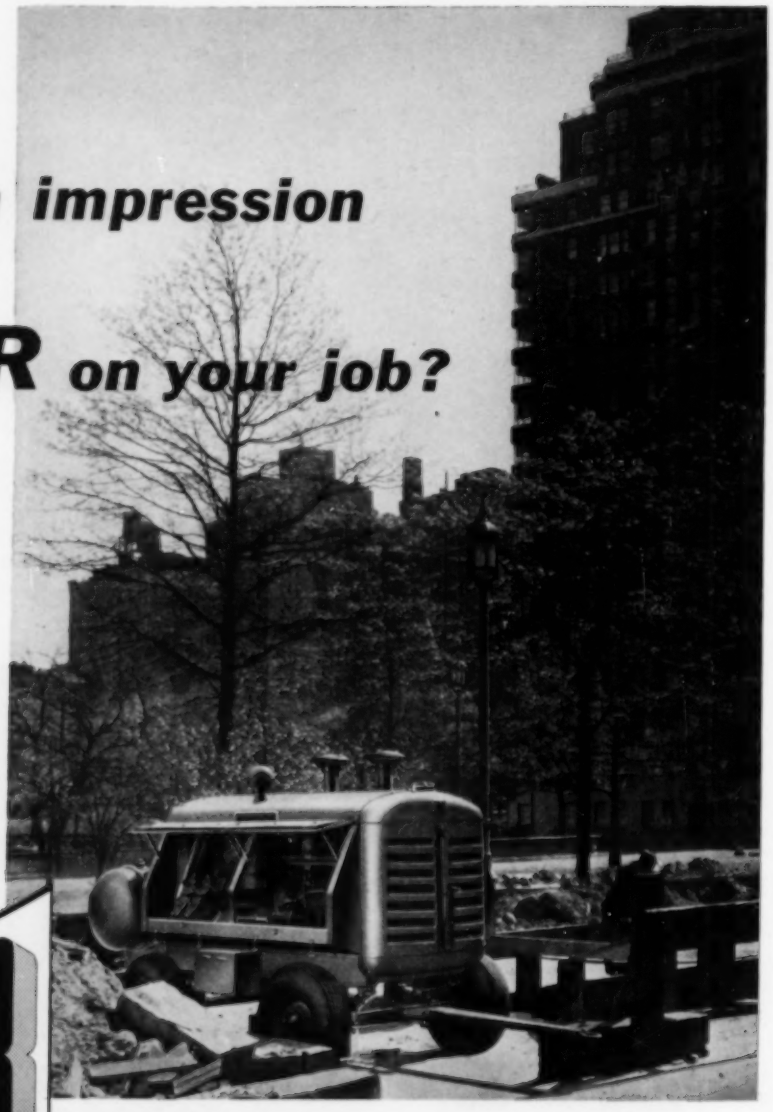
DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

DOLLINGER CORPORATION

7 CENTRE PK., ROCHESTER 3, N. Y.

Representatives in Principal Cities

Do you make an impression when you put AIR POWER on your job?



Ingersoll-Rand
MOBIL-AIR
AIR POWER

MOBIL-AIR Power makes a *big* impression. It builds prestige that gets you more and bigger jobs.

MOBIL-AIR Compressors, and the other members of the "I-R Contractor Team," bring you more profit, too, doing your jobs *quicker*, and doing the *"impossible."* You handle *more* jobs. More profit every time.

MOBIL-AIR Compressors created and built by Ingersoll-Rand are durable, reliable, resistant to depreciation... They're husky and efficient, and have plenty of reserve.

MOBIL-AIR Compressors are equipped with Drill-More Multi-Speed Capacity Control for bigger fuel savings, for longer compressor life, and for greater drill power. You'll make more money with MOBIL-AIR Compressors on your job.

DON'T STOP WITH A GOOD COMPRESSOR!

Use the IR CONTRACTORS' COMBINATION

1. Everything you need for rock drilling.
2. Top quality machines that work as a team.
3. Machines designed, built, sold, and serviced by men who know rock excavation.
4. Application "know how."

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 155-2

POWELL makes a *complete* line of valves for COMPRESSED AIR SERVICES

After one hundred and two years of operation, we are more than ever convinced of the soundness of the policy we adopted more than a century ago. This was to make valves ***only*** and to make ***every kind*** of valve that industry might require.

One of the results of strict adherence to this policy through the years is an exceptionally complete line of Powell Valves for Compressed Air Services. This includes not only valves of all required types, designs and sizes for controlling the flow of compressed air but also the flow of water for cooling air compressors.

The Wm. Powell Co., Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

Fig. 1793—Large 125-pound Iron Body Bronze Mounted O.S.& Y. Gate Valve.

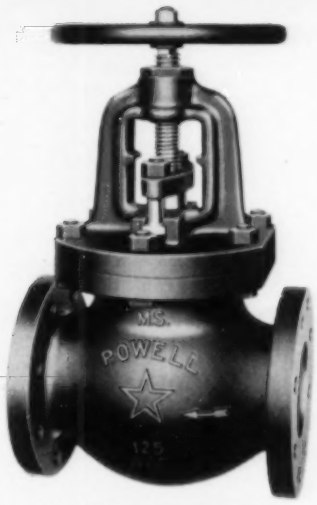


Fig. 241—Large 125-pound Iron Body Bronze Mounted O. S. & Y. Globe Valve.

Fig. 175—Bronze Hydraulic Regrinding Globe Valve for 2000 pounds W. W. P. Has regrindable, renewable "Powellium" nickel-bronze disc.

Fig. 95—Bronze Dash Pot Check Valve for 200 pounds air working pressure. Cushioning effect of plunger in dash pot makes seating of the disc practically noiseless.

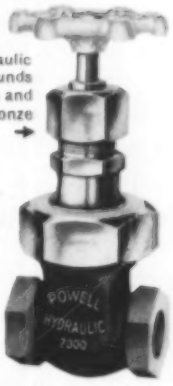


Fig. 178 — Bronze Hydraulic Gate Valve for 2000 pounds W.W.P. Non-rising stem and "Powellium" nickel - bronze tapered solid wedge.

Fig. 150—150-pound Bronze Globe Valve with renewable composition disc.

Fig. 375 — 200 - pound Bronze Gate Valve with renewable "Powellium" nickel-bronze disc.

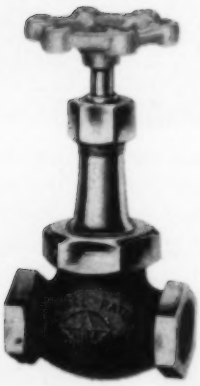


Fig. 1708—200-pound Bronze Globe Valve with renewable stainless steel seat and regrindable, renewable "Powellium" nickel-bronze disc.

Fig. 560—200-pound Bronze Regrinding Horizontal Swing Check Valve.

Fig. 559 — 125-pound Iron Body Bronze Mounted Swing Check Valve with regrindable, renewable seat and disc.

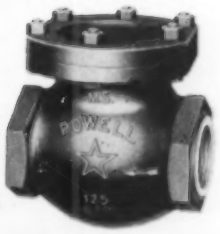


Fig. 311—125-pound Iron Body Bronze Mounted Horizontal Lift Check Valve with vulcanized composition disc.

POWELL VALVES

CONVERT DUST INTO DOLLARS

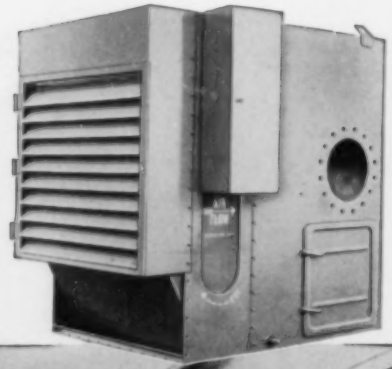
AAF Multi-Duty Air Filters return dollar savings by eliminating dust damage

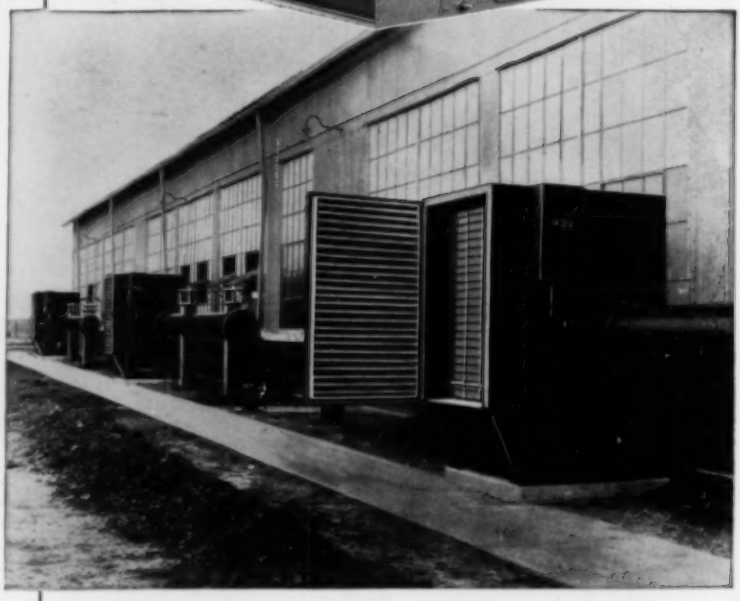
THE more than 3000 Multi-Duty Self-Cleaning Air Filters now in service give proof to the fact that the cost of clean air is incidental to the savings.

The Multi-Duty Type CMS is an automatic, self-cleaning air filter built to withstand the severe conditions of engine and compressor service. It features the AAF overlapping panel curtain which makes possible both the delivery of a uniform volume of clean air and a positive, trouble-free, self-cleaning operation. The Multi-Duty is truly automatic. Its operating resistance remains fixed when once established for a given dust concentration and requires no attention other than periodic inspection and the removal of sludge at regular intervals.

Multi-Duty filters for outdoor installation are usually supplied as a housed unit consisting of front louvers for protection of the filter curtain and a plenum chamber to which engine or compressor intake is connected. A perforated metal baffle in plenum chamber dampens intake pulsations and distributes air flow uniformly over the entire curtain area of the filter.

If you want to convert dust damage into tangible dollar savings, write today for complete information on the AAF Multi-Duty Self-Cleaning Air Filter.





AMERICAN AIR FILTER COMPANY, INC.
402 Central Ave., Louisville 8, Ky.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

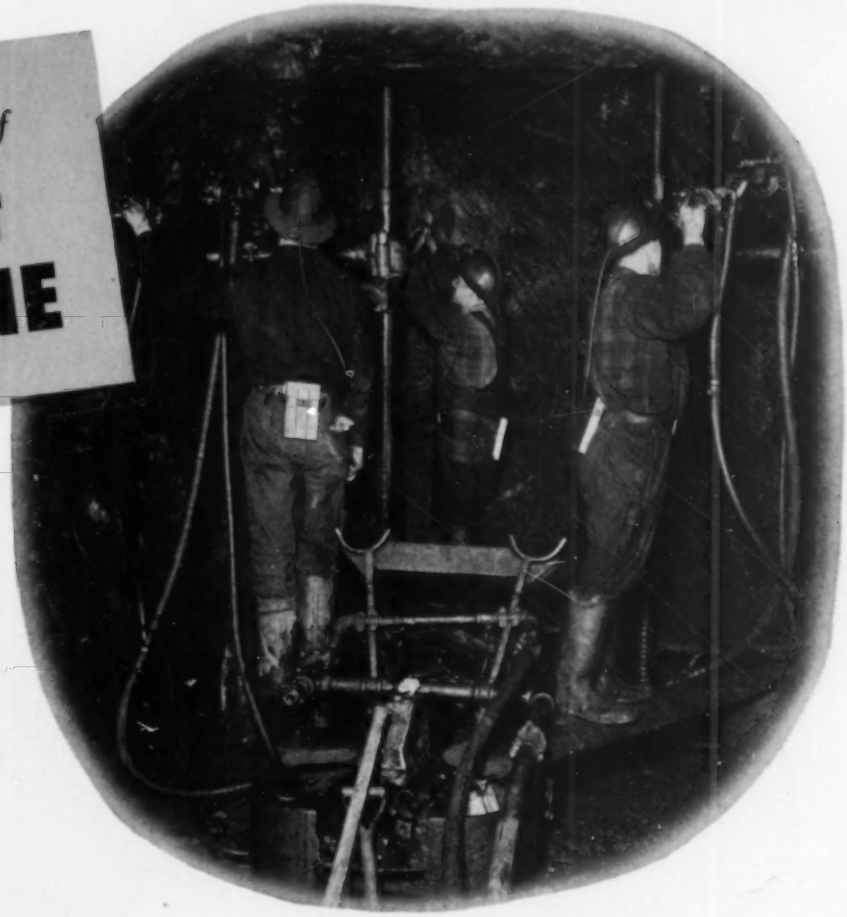
FREE FOR THE ASKING!
New Bulletin No. 150 contains complete data on Multi-Duty filters for engine and compressor service.

AAF
AIR FILTERS
AND DUST CONTROL EQUIPMENT

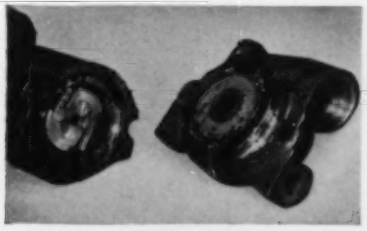
Down in the mine this air hose withstands oil, abrasion, flex-cracking and aging

...because tube and cover are made of

Du Pont NEOPRENE



NEOPRENE PREVENTS TROUBLE LIKE THIS



Jackhammer, partially dismantled, shows accumulation of disintegrated rubber hose which has almost clogged up air ports in the valve and rifle bar assembly.

No matter where this air hose is used in mines, it stands up under the toughest operating conditions. For both inside and out . . . it's protected with tough, durable neoprene.

The neoprene tube won't disintegrate when exposed to lubricating oil. So no crumbled particles or chunks will be carried along to clog the tool (as shown at right). And neoprene not only prevents tool clogging. But, because it retains its strength and toughness, it constantly protects the fabric reinforcement from oil, heat and moisture which rot the fabric and lead to blowouts.

Cover is made of neoprene, too. Neoprene won't crack or soften when used underground or out in the summer sun, driving rains and icy winter temperatures encountered in strip mines. And a neoprene cover can take the punishment of yanking, twisting and dragging it over sharp rocks and rough debris. For neoprene withstands cutting, chipping, abrasion and flex-cracking.

So make sure of long service life . . . low replacement costs on the air hose you use. Ask your supplier for hose made with neoprene tube and cover. A neoprene hose stands up in the toughest service encountered year after year.

E. I. du Pont de Nemours & Co. (Inc.), Rubber Chemicals Division Y-12, Wilmington 98, Delaware.

Tune in Du Pont "Cavalcade of America," Monday nights—NBC coast to coast.

DU PONT
REG. U. S. PAT. OFF.

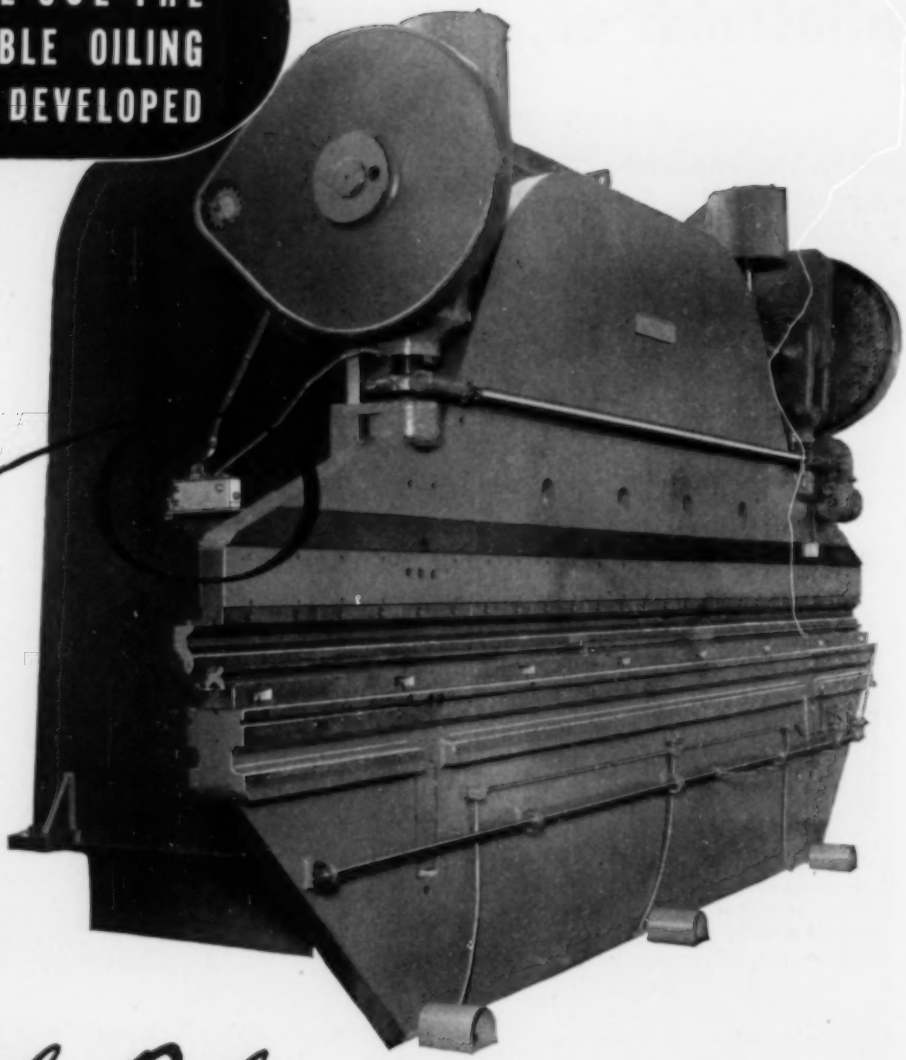
BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

SPECIFY HOSE MADE OF

NEOPRENE

The rubber made by Du Pont

MACHINES OF GREAT PERFORMANCE USE THE MOST DEPENDABLE OILING SYSTEM EVER DEVELOPED



Illustrated is Madison-Kipp Lubricator Model FD installed as original equipment on a ⅜" by 20' Cincinnati Press Brake, manufactured by the Cincinnati Shaper Co., Cincinnati, Ohio.

MADISON-KIPP *Fresh Oil*

. . . by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

MADISON-KIPP CORPORATION

202 Waubesa Street, Madison 10, Wis., U.S.A.

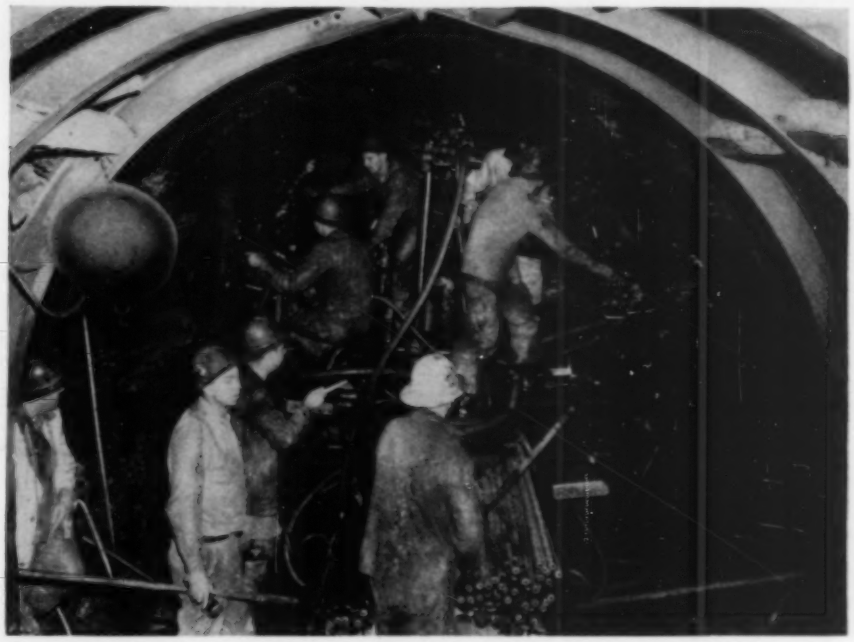
ANCIENS ATELIERS GASQUY, 31 Rue du Marias, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia, and New Zealand.

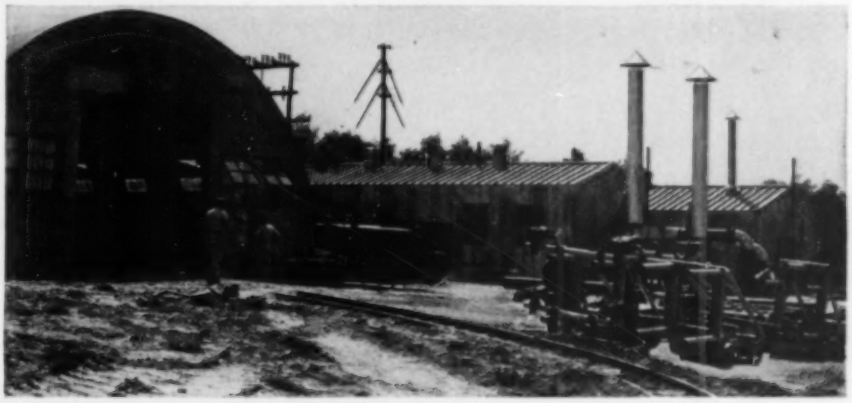
- *Skilled in* DIE CASTING *Mechanics*
- *Experienced in* LUBRICATION *Engineering*
- *Originators of Really High Speed* AIR TOOLS

7-mile tunnel holed through

as Baltimore expands Water Supply



Tunnel driving is a specialty of the Rosoff organization. This view shows one of the jumbos in action, mounting five 3½-in. drifters. Using Bethlehem Hollow Drill Steel exclusively, the contractor employed forged bits to drill the relatively hard formations.



Buildings at the site of the Druid Park Shaft include the central blacksmith shop, compressor house, and change house. Note the jumbos in right foreground.

The excavation of the Liberty Road-Montebello Tunnel has just been completed by Samuel R. Rosoff, Ltd., for the Bureau of Water Supply, of the city of Baltimore. The 10-mile Patapsco-Liberty Road Tunnel is the next big job. Due for completion in 1951, this project has also been awarded to Rosoff.

It's all a part of Baltimore's Patapsco Development, involving the construction of 17 miles of water tunnel, which will increase Baltimore's water supply to the tune of 50 million gallons each day.

Beginning work on the first underground bore in October, 1947, the contractor a few months later was operating from six headings, utilizing four shafts previously sunk. With jumbos mounting five drifters each, the average drill round consisted of from 29 to 32 holes, 7 to 9 ft deep. The diameter excavated ranged from 9 ft, 4 in. to 11 ft. Holing through occurred on September 10, 1948, between the Stoney Run and Montebello shafts, the last section of the tunnel to be driven.

Using Bethlehem Hollow Drill Steel exclusively, the contractor forged his own bits in the central blacksmith shop at the Druid shaft. Here all steel was sharpened in three daily shifts and issued to the various tunnel headings. Drill steel was employed in 2-ft changes, beginning with 3-ft starters, the bit gauge being reduced ⅛-in. with each increase in length.

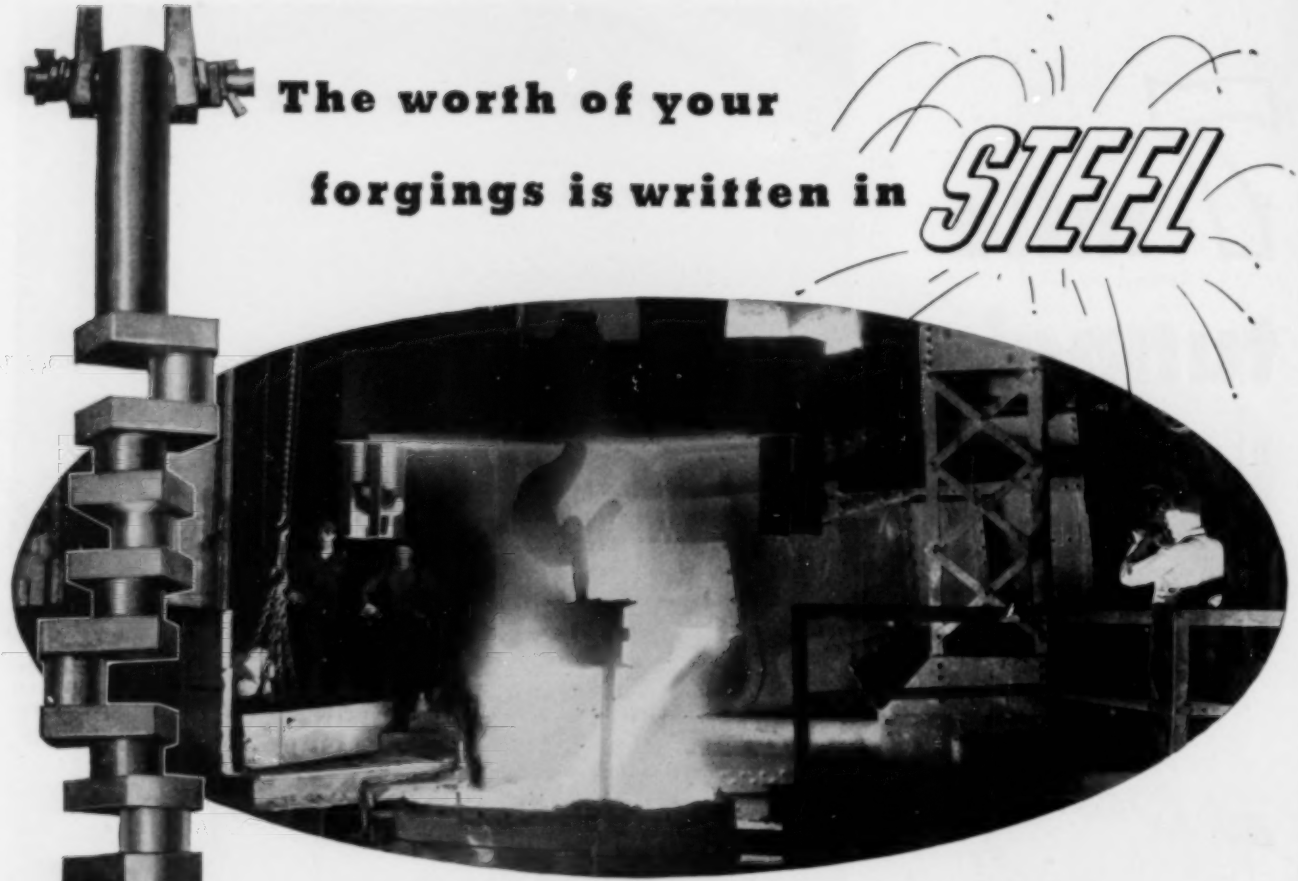
BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

★ BETHLEHEM STEEL ★

BETHLEHEM HOLLOW DRILL STEEL

The worth of your forgings is written in STEEL



THAT'S WHY—to be sure that the steel *is* right—you find the steel for each forging at National Forge individually melted in basic electric furnaces . . . for basic electric steel is the first "must" in making forgings of optimum quality.

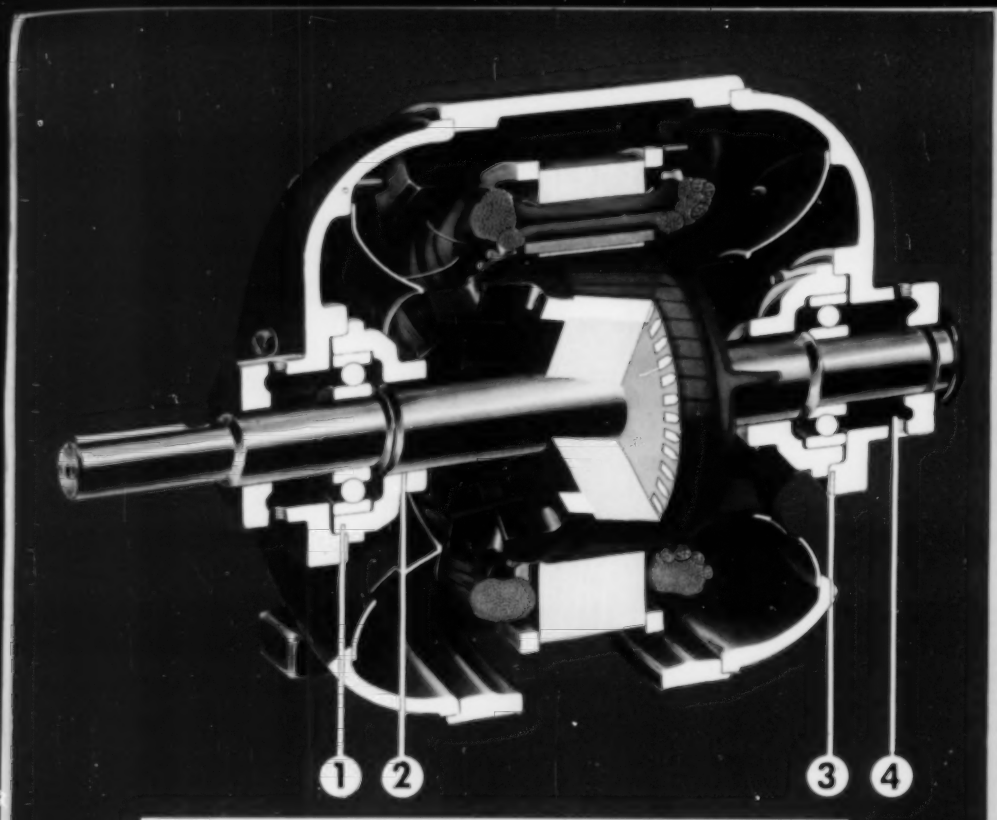
From thirty-five years of steel forging experience, we at National Forge know there is no steel like basic electric for forging purposes. Made from the best raw materials, melted and refined by skilled men, controlled metallurgically from start to finish, all the art and science of modern steel making contribute to the high quality of National Forge basic electric forging steel.

So be steel minded when you order your forgings—and also remember that the forgesmithing, heat-treating and finish machining will be in exceedingly competent, well equipped hands when your steel forgings are National Forged.

Let us tell you the many critical reasons for insisting on basic electric steel, for it will pay you to know these facts as National Forge can give them to you from long-time steel forging experience.

National Forge
AND ORDNANCE COMPANY
Irvine, Warren County, Pennsylvania
STEEL MAKERS • FORGESMITHS
HEAT TREATERS • MACHINISTS

YOU CAN'T BEAT A
TRI CLAD MOTOR FOR
EASY MAINTENANCE
GENERAL ELECTRIC
HERE'S
WHY



Notice (1) how Tri-Clad bearings are surrounded by and rigidly supported in solid cast-iron housings. Compare the long, close-running fit between housing and shaft (2) with other motor bearings. Examine the tight rabbet fit between inner cap and end shield (3) which keeps dust and moisture out and lubricant in. See, too, the pressure-relief greasing system (4) that makes it easy to lubricate if you need to.

You can't beat a TRI/CLAD motor for easy maintenance

A TRI-CLAD MOTOR will run safely without lubrication for years—for as long as any other general-purpose motor you can buy. The big thing is—it's *grease-gun easy* to lubricate a Tri-Clad if you need to.

You don't have to take a Tri-Clad motor down and disassemble the bearings to lubricate it. You don't have to follow special instructions. A standard gun and a good grease are all you need.

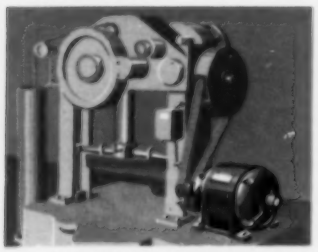
And remember, Tri-Clad gives you all the extra protection that only cast-iron structure can give . . . Extra protection against rust and corrosion . . . Extra protection against mechanical abuse and permanent distortion . . .

Extra protection that has been proved in more than 5 billion hours of rough-and-tumble industrial service.

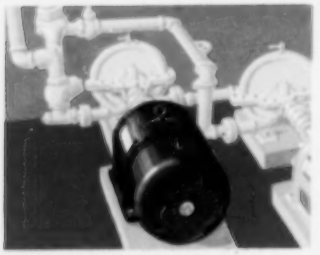
WANT TO SEE FOR YOURSELF? Tri-Clad motors in nearly all types and ratings are ready for **IMMEDIATE SHIPMENT.** Contact your nearest G-E Office or write *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

There's a Tri-Clad motor for every industrial need!

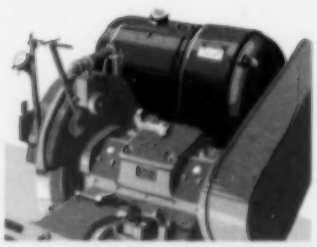


G-E open (dripproof) induction motors for constant-load, constant-speed applications. From 1 to 2000 hp.



G-E totally enclosed motors for operation where dust or corrosive fumes are a hazard. From 1 to 1000 hp.

G-E capacitor motors for use on fans, blowers, pumps and compressors with single-phase power. From ¾ to 5 hp.

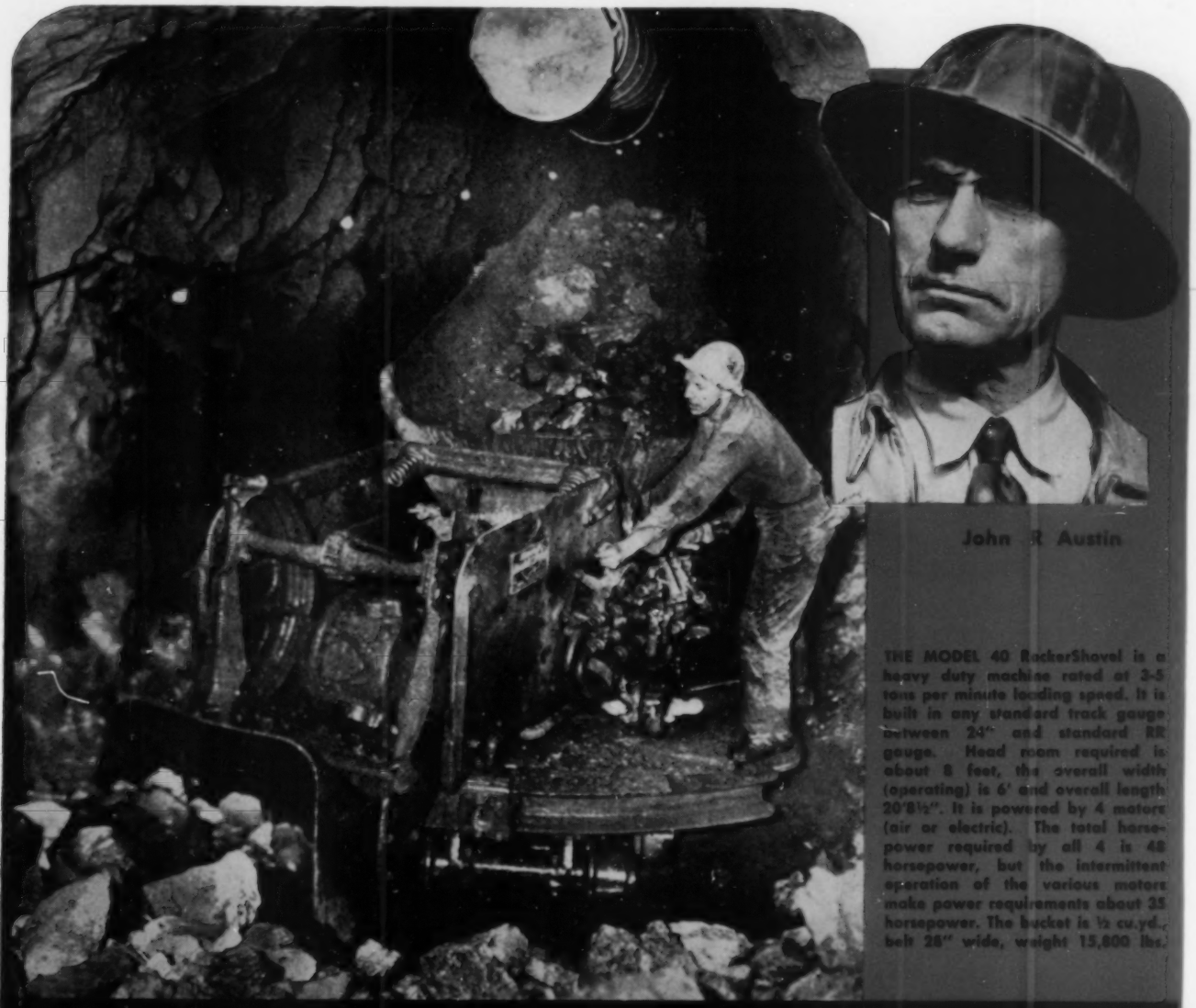


G-E Type ACA induction motors for adjustable speeds—provide 3 to 1 speed range. From 3 to 200 hp.

YOU CAN'T BEAT

TRI/CLAD

EXTRA PROTECTION



John R Austin

THE MODEL 40 RockerShovel is a heavy duty machine rated at 3-5 tons per minute loading speed. It is built in any standard track gauge between 24" and standard RR gauge. Head room required is about 8 feet, the overall width (operating) is 6' and overall length 20'8½". It is powered by 4 motors (air or electric). The total horsepower required by all 4 is 48 horsepower, but the intermittent operation of the various motors make power requirements about 25 horsepower. The bucket is ½ cu.yd., belt 28" wide, weight 15,800 lbs.

High Speed Tunnels

John Austin of Tunnel Constructors, Inc. uses his Model 40 RockerShovel to speed his tunnels to completion. While the loads are pulled away to a nearby California switch, the big Model 40 loads the conveyor all the way back to get ready for the next car. This cuts actual loading time average of the 4 ton car to 35 seconds.

The speed and power of the Model 40 make it the choice of high speed tunnel contractors. World's records (still standing) for speed in tunnel advance were made by men using RockerShovels.

EIMCO

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES — SALT LAKE CITY 8, UTAH, U. S. A.

BRANCHES: NEW YORK, CHICAGO, BIRMINGHAM, EL PASO, SACRAMENTO, MANILA

AFFILIATED COMPANIES: SOCIETE EIMCO, PARIS, FRANCE
EIMCO (GREAT BRITAIN) LTD., LEEDS 12, ENGLAND
AGENTS IN ALL PRINCIPAL CITIES THROUGHOUT THE WORLD

AIR POWER

PAYS FOR ITSELF nearly TWICE as fast now

Time and cost studies prove this...

Ingersoll-Rand Air Power equipment which, a few years ago, saved enough to pay for itself in 30 days...

now pays for itself in only 18 days . . . on the same operations under today's conditions.

To find out exactly what this fast pay-off time on Air Power equipment means to you, ask your Ingersoll-Rand engineer to make a job study in your plant. He will help you make actual Air Tool performance tests right on your own operations . . . then help you determine how much money you can save, and how quickly Air Power equipment will pay for itself.

AIR POWER

The Key to Lower Production Costs

Ingersoll-Rand

11 Broadway, New York 4, N. Y.

329-8

"With these clean, compact units, we can change speeds without stopping ...get in-between speeds we need."

FOR GREATER MACHINE OUTPUT in *your* plant, get the same variable speed drive that makes mill foreman Ralph Finkboner of Rochelle, Illinois, so enthusiastic. Texrope Vari-Pitch Speed Changers give you smooth, accurate speed control at the turn of a crank. You operate your machines at *exactly* the right speed for highest production.

V-belt drive cushions Texrope Vari-Pitch Speed Changers against shock loads. Design is simple, compact, smooth running and easy to keep clean. Capacities range from 1 to 75 HP with stepless speeds up to 3.75 to 1.

Texrope Authorized Dealers and Allis-Chalmers District Offices have at their command the greatest V-belt experience in the industry. Consult them and be *sure* of the best drive for your particular need. Listed in SWEET'S. A 2541

ALLIS-CHALMERS, 1000A SO. 70 ST.
MILWAUKEE, WIS.

Texrope, Super-7, Texsteel, Texdrive, Magic-Grip and Vari-Pitch are Allis-Chalmers trademarks

A Complete Range of Products		
Super-7 V-belts	5 types . . . sizes to suit every power transmission job	
Texsteel, Texdrive, Magic-Grip	Sheaves in a full range of sizes and grooves	
Vari-Pitch Sheaves	Exact variations in speed — Stationary or Motion control	
Speed Changers	Speed variations up to 375% at the turn of a crank	

Texrope Super-7 V-belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices.

ALLIS-CHALMERS

Originators of the Multiple V-belt Drive for Industry

Confidence—WITH ITS SLEEVES ROLLED UP!

ATOP THE WORLD'S TALLEST BUILDING . . . yet not high enough! Television's need for unobstructed, long-range broadcasts may be met by planes in the stratosphere, relaying signals from the earth. Engineers working on this problem are confident of ultimate success.

With like confidence, Roebling blazes new trails in developing and making products vital to communication and all other industries. And the widespread confidence reposed in Roebling is our most guarded asset. Leadership is maintained only by constant progress . . . our ideal is to make Roebling products and engineering service the best obtainable anywhere, *any* time.

WHEN TO SPECIFY ROEBLING *Preformed* WIRE ROPE

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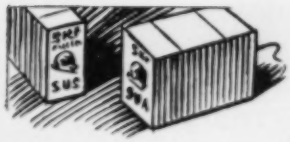

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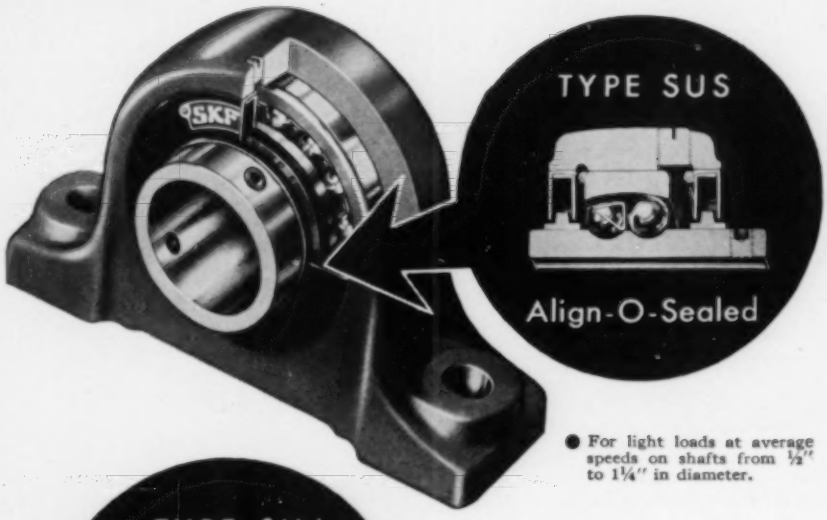

● For light loads at average speeds on shafts from ½" to 1¼" in diameter.

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THE EXCLUSIVE SKF ALIGN-O-SEAL

A ring rotates with the shaft and within the U-shaped section of a circular cover. In the inside wall of the cover, facing the bearing, are evenly spaced holes which act as relief valves for excess grease. Overgreasing of the bearing is automatically relieved through these holes.

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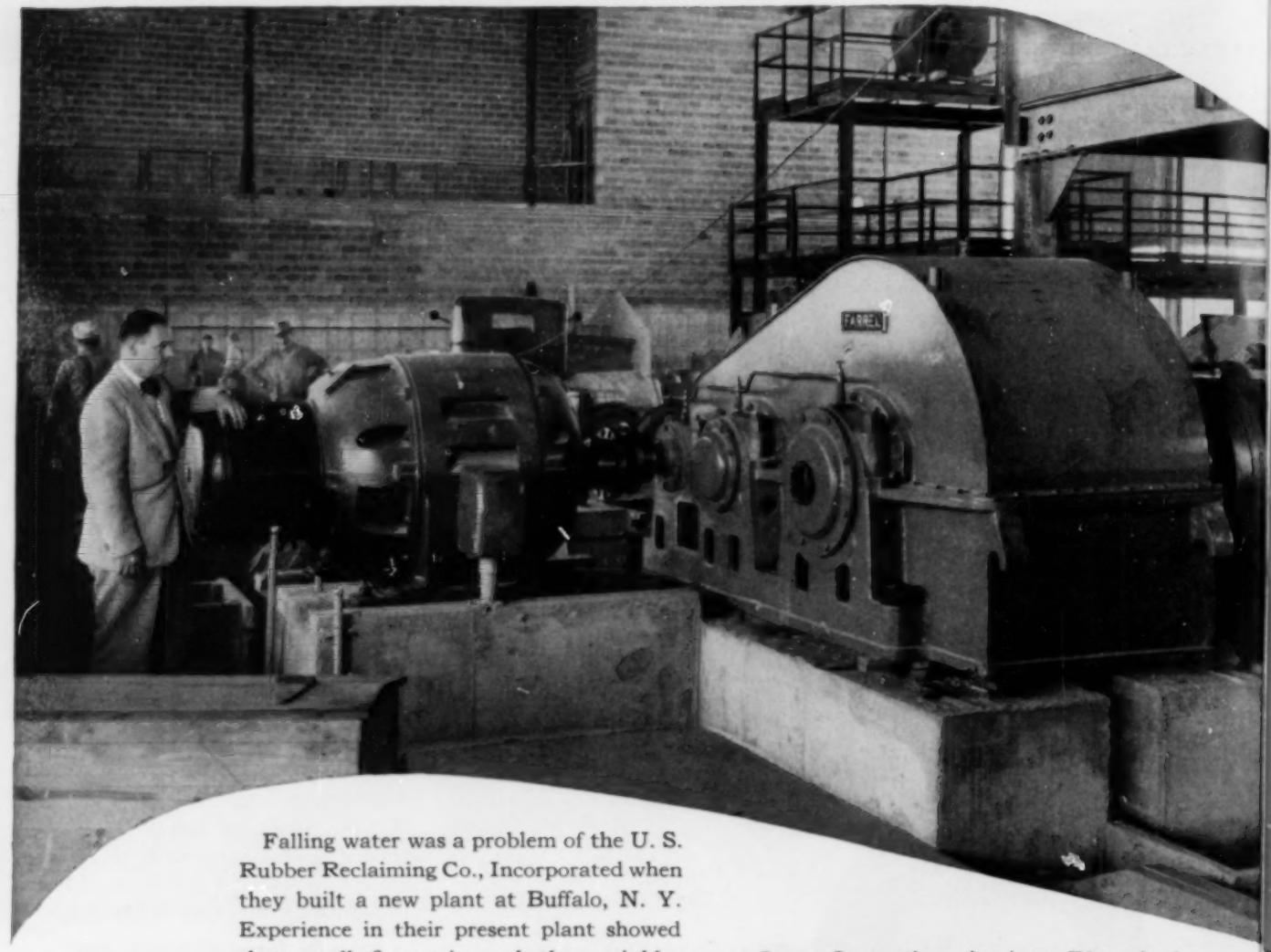
PILLOW BLOCKS



Falling water was a problem of the U. S. Rubber Reclaiming Co., Incorporated when they built a new plant at Buffalo, N. Y. Experience in their present plant showed that small fires triggered the sprinkler system and made motors inoperative. In planning the new plant, the need for motors shielded against falling water was recognized. Also, insurance officials required greater motor protection in the new plant —a need that was filled by Tri-Clad high-speed synchronous motors. Now, no production time is lost because of water in motors.

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Extra Protection Against Physical Damage—sturdy, rigid frames and end shields for protection against corrosion, accidental blows, and falling objects.

Extra Protection Against Electrical Breakdown—proved synthetic bonding and insulating compounds protect coils from heat aging, moisture, mild acids and alkalies. Insure longer life.

Extra Protection Against Operating Wear and Tear—redesigned bearings and bearing housings insure a permanent supply of cool, clean oil from sealed reservoirs.

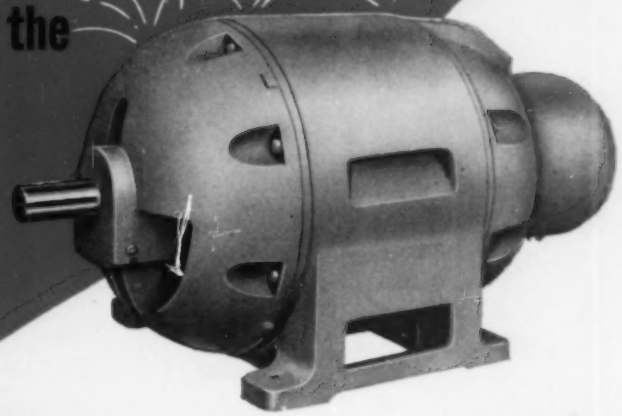
Delivery on Tri-Clad high-speed synchronous motors and generators is good. Motors are available in ratings from 20 to 1500 hp at 1800 rpm speeds with proportionate hp ratings at speeds through 514 rpm. Generators from 1¼ to 1250 kva. For application engineering and delivery data, call your nearest G-E sales representative today. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

770-2

Can a "Sprinkle" Stop Your Plant?

Tri-Clad synchronous motors and generators stay on the job when water falls.



2 Write today! DESCRIPTIVE BULLETINS

Two new bulletins describing Tri-Clad high-speed synchronous motors and generators are available now. Ask for GEA-5113, Tri-Clad High-Speed Synchronous Motors, and GEA-5125, Tri-Clad High-Speed Synchronous Generators. Get the full story on the protection value of this new line of motors and generators.

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Give up to 1000 Times Longer Service

Are you blast cleaning with NORBIDE Nozzles — the longest wearing nozzles ever made? Where cast iron nozzles are worn out in hours, NORBIDE Nozzles last weeks, sometimes months. Why this great resistance to abrasion? Because NORBIDE Nozzles are made of Norton Boron Carbide — "the hardest material made by man".

Because the orifice of a NORBIDE Nozzle is not quickly worn larger the blast stream remains concentrated for a long period of service and air consumption (a costly item in itself) is reduced 10 to 20% over other types of nozzles. For further information on nozzles which will give you up to 1000 times longer service we invite you to write to:

Norbide Divison

NORTON COMPANY—WORCESTER 6, MASS.

NORBID*—Reg. Trade-mark for Norton Boron Carbide

***Hardest Material Made by Man**

ON THE COVER

SCENES such as this one will be re-enacted before long in the north Temperate Zone. The picture, taken last winter, shows special equipment slicing down the sheer face of a drift in one of the northern counties of Michigan. As the plow advances, the snow is drawn into two augerlike conveyors and moved to a fan that blows it as far as 100 feet away from the highway. Under the conditions illustrated the equipment will travel at a speed ranging from 2 to 3 miles an hour.

•

IN THIS ISSUE

SIXTEEN years ago we described the Little Falls (N.J.) Laundry, which is the subject of the first article in this issue. Then, as now, it was probably the largest establishment of its kind. It is significant that the compressed-air supply has doubled during the intervening years, though the number of customers remains substantially the same. This clearly indicates the growth of air power in laundering.

•

THE advantages of water-vapor refrigeration for certain services are so clear cut that the applications of this relatively new method of cooling are steadily widening. The article starting on page 297 outlines the working principles of the system and describes typical uses.

•

BECAUSE wages are rising faster than the cost of compressed-air equipment, it will pay most industrial establishments to increase their use of air power. This, in brief, is the theme of an "Air Power Campaign" promoted by Ingersoll-Rand Company and backed up by an offer to prove the economy of its products through actual demonstrations in the users' plants. See page 293.

Compressed Air Magazine

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EDITORIAL CONTENTS

Laundering for the Multitude—*C. H. Vivian* 288
Saving Money with Air Power—*Allen S. Park* 293
Water-Vapor Refrigeration—*H. R. Havemeyer* 297
Curbing Industrial Smoke with Jets of Air 301
Automatic Spray Booth for Painting Steel Barrels 303
How Michigan Battles Snow and Ice 304
Editorials—Tools for Industry—Standard Screw Threads 306
This and That 307
Industrial Notes 308
Industrial Literature 310

ADVERTISING INDEX

Allis-Chalmers 15
American Filter Co., Inc. 6
Armstrong Machine Works 34
Bethlehem Steel Co. 9
Bucyrus-Erie Co. 27
Burgess-Manning Co. 32
Canadian Ingersoll-Rand Co. Ltd. 26
Cook Mfg. Co., C. Lee 28
Crane Co. 33
Crucible Steel Co. of America 3rd Cover
Dollinger Corp. 3
du Pont de Nemours & Co. (Inc.) 7
Eimco Corp., The 13
Hannifin Corp. 34
Garlock Packing Co., The 35
General Electric Co. 11, 12, 18, 19, 36, 37
Industrial Clutch Co. 30
Ingersoll-Rand Co. 4, 14, 29, 38
Koh-I-Nor Pencil Co., Inc. 35
Madison-Kipp Corp. 8
Maxim Silencer Co., The 34
National Forge & Ordnance Co. 10
New Jersey Meter Co. 32
Niagara Blower Co. 22
Nicholson & Co., W. H. 35
Norgren Co., C. A. 21
Norton Co. 20
Powell Co., The Wm. 5
Roebling's Sons Co., John A. 16
SKF Industries, Inc. 17
Square D Co. 32
Texas Co., The ..... 2nd Cover
Timken Roller Bearing Co., The 4th Cover
Victaulic Co. of America 23
Vogt Machine Co., Inc., Henry 31
Walworth Co. 24
Waukesha Motor Co. 25

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OFFICE AND PART OF PLANT
At the right is the entrance to the modern office building. The other picture shows women customers and buses that brought them as guests of the management to see just how their clothes and household fabrics are washed and ironed. A part of the laundry is in the background.

Laundering for the Multitude

A Five-Brother Business Applies Scientific Methods and Mechanical Ingenuity in Cleansing Wearing Apparel and Household Fabrics for 100,000 Persons

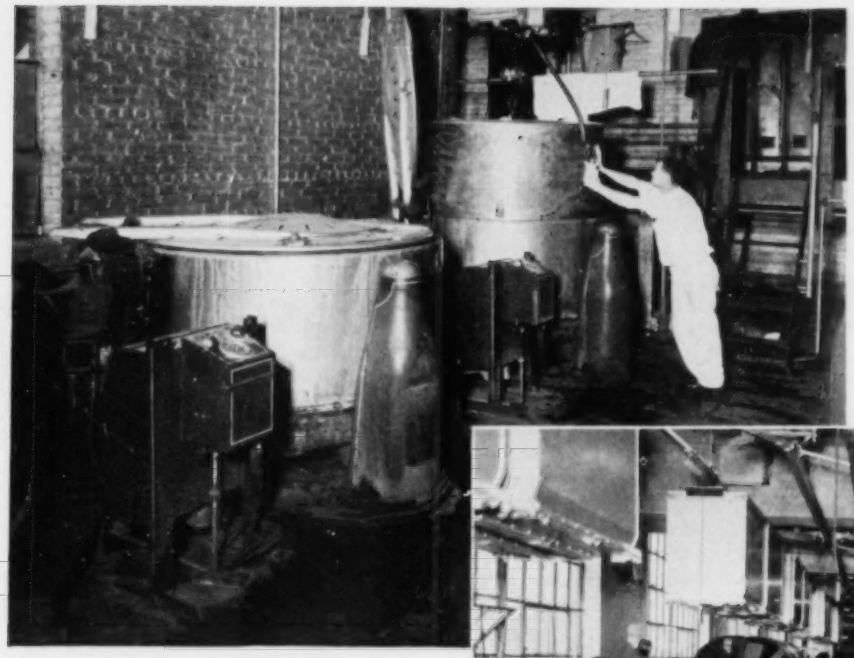
C. H. Vivian

PROBABLY the largest plant of its kind anywhere, the Little Falls Laundry, Little Falls, N. J., took root in a truck garden. On its site, a few miles from the city of Paterson, George Vander May, of Holland ancestry, established a home around the turn of the century. As his six sons grew up they sold produce, hauling it throughout the neighboring area in horse-drawn wagons. Central laundries were then virtually unknown, and many of their customers asked the boys if they knew where there was a good washerwoman. Housewives put the question so often that the brothers decided to combine a clothes-washing service with their huckster business. They were influenced to take this step by a stream of water that ran through the farm. This same stream, the Peckman River, is still one of the laundry's assets, as it supplies the great quantities of water used daily.

The new venture was started in December, 1912, in a one-story frame structure that also served as a vegetable storehouse. It was initially called the Little Falls Washing Company and prospered from the outset. As the plant grew it was periodically enlarged. The latest expansion was in 1933 when a modern office building was erected and a large 2-story structure was put up to house the garage and rug-cleaning facilities. The present name of Little Falls Laundry Company was adopted in 1925. As in the beginning, the business is still a partnership, and five of the brothers—Garret, John, Herman, Nicholas, and Samuel—remain active in it. Originally the concern offered only wet-wash service. Then it made plans also to finish laundry. Gradually it added dry cleaning, rug shampooing, fur cleaning and glazing, and rug and fur storage. Now it washes every article of wearing apparel except shoes, and most of the fabric furnishings that are used in the average household.

Today the laundry employs around 500 people and serves 25,000 families, or approximately 100,000 persons. It draws customers from a 100x50-mile territory—an area of 5000 square miles, which extends from Suffern, N. Y., on the north to Toms River, N. J., on the south, and from the Hudson River on the east to Hackettstown, N. J., on the west. To cover this expanse it maintains 106 delivery trucks and some twenty miscellaneous cars, which travel upwards of 15,000 miles a week. Truck bodies are made to order, with the interiors arranged to expedite the handling of the different kinds of things carried. They are long enough to stow 16-foot rugs. Chassis weigh 1½ tons, which is unusually heavy for laundry routes, and some of the vehicles remain on the road 10 or 15 years. Red Bank, N. J., 50 miles from the laundry, is a distribution center with a branch office. Between 15 and 20 trucks fan out from there into the shore area, collecting and delivering. Aluminum trailer trucks of boxcar proportions, each with a capacity of 2½ truck loads, run between Red Bank and Little Falls.

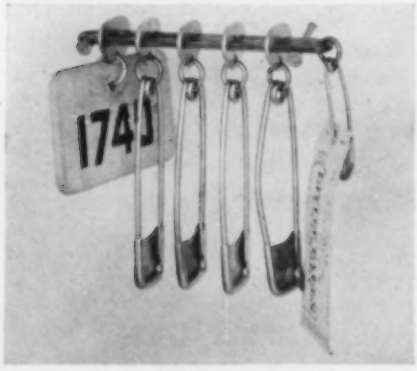
To the public, the truck-driver salesmen are the Little Falls Laundry. They pick up and return the work, collect for it, adjust complaints, and otherwise represent the concern. Needless to say, they are selected with care and instructed in every phase of the business to make them self-sufficient. As a part of



their training they study a 48-page sales manual that sets forth just about everything they will have to know. In addition to this course they familiarize themselves with every plant operation. Since they sell "cleanliness," they and their equipment are always immaculate. The company furnishes the uniforms, which are cleaned without charge. White shirts are a part of their attire and are laundered gratis.

Before the war imposed restrictions, salesmen called on customers twice weekly; since then they make but one call. An acute shortage of help developed in the Little Falls district during the period of hostilities and is still rather serious. Even now the plant draws its employees from a considerable area, running a bus to and from Butler, N. J., 15 miles away, for the convenience of those living around there.

The laundry does practically no cash-and-carry business, all work flowing in and out by truck. Customers who want service outside of the regular schedule telephone the office. As many as 10,000 calls are received monthly, and the central switchboard shunts them to trained workers who are equipped to take care of them in the shortest possible time. On each of their desks is a revolving file that can be referred to instantly. It lists towns and streets, and after each one is a code serial number that indicates the day of service and the driver concerned.



IDENTIFICATION DISKS

While being washed, the various separations or lots of clothes, etc., belonging to one customer are tagged with the disks shown here on their master bar which they alone will fit. Bar and disks bear the same number. The bar, with a ticket showing the customer's name and address and kind of service desired, goes to the finished-wash assembly department. As each separation reaches that point the disk is removed and put back on the bar. When all have been accounted for, it is known that all the pieces in a bundle of wash have been completed.

WASHING AND DRYING CLOTHES

The bottom view shows two rows of American Laundry Machinery Company Cascade washers, each of which holds 400 pounds of dry clothes. Workmen on the left side midway of the illustration are removing net-encased garments from the inside cage of an open washer. They will be placed in one of the containers in the foreground, picked up by a hoist suspended from overhead rails, and moved to moisture extractors (upper picture). In the latter, the clothes are spun at 750 rpm. for eleven minutes and emerge dry enough for ironing. The machine in the background is being loaded. Between the washers are stands from which the entire cycle is automatically controlled. The governing element is a metal formula plate about the size and thickness of a phonograph record and perforated with as many holes as there are operations. The plate is slowly turned by a timing motor, and as indexing pins contact the perforations they actuate air valves that transmit impulses to the respective mechanisms which control the operations. Thus the correct quantities of water and supplies are introduced at the exact times specified; the temperature of the water is adjusted to the right degree; clothes are washed and rinsed for stipulated periods; and the washers are drained and refilled as scheduled. The supplies such as soap and detergents are put in compartments in the control stand and then mixed automatically with water. At designated times, measured amounts of the solutions are siphoned into the washer. All that is required of the operator is to insert the proper formula plate, fill the supply compartments, and push a "start" button. Under manual control he would have to perform as many as 62 operations during each washing period. Colored lights on the control stand indicate the various stages of the cycle. A whistle blows when it is completed, or when a temporary stop has been included on the formula plate to enable the operator to carry out some special function.

Having this information close at hand eliminates many words, and the seconds or minutes saved in carrying on each conversation permit handling many more calls per day.

A modern laundry is virtually a chemical processing plant. Its staff must know what combination of detergents and soaps with water gives the best results for a certain fabric, how the dyes in textiles of all sorts react under different treatments, the permissible and most effective water temperatures in each case, how to remove stains of many origins, and countless other things. By applying scientific research to these matters and utilizing properly designed closely controlled equipment, progressive laundries maintain that they can wash clothes better and with less wear and tear than can the housewife herself. The Little Falls Laundry stands ready to demonstrate this to its customers at any time.

A few years ago the management transported 30,000 women over a period of six weeks to inspect the plant. This required 750 bus-trips, and the advertising venture cost $30,000. Through the years, great dependence has been placed on newspaper advertising, and it is now run in six New Jersey papers. Billboards also carry sales messages, and radio has been tried from time to time. One of the most effective means of publicity is printed material distributed by the driver-salesmen.

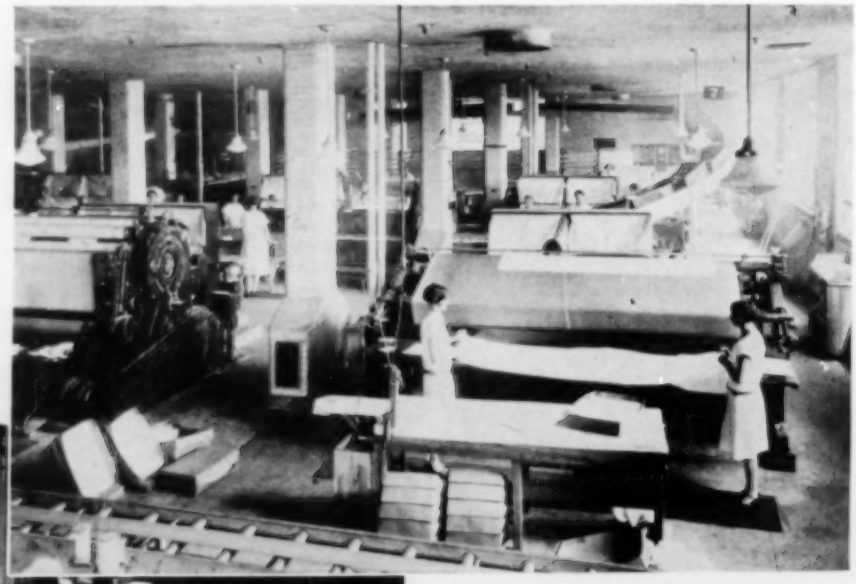
Housewives who do their own washing or have laundresses ordinarily must use the water at hand. First-class laundries find this unsatisfactory and treat their water to soften it. Raw water for the Little Falls plant flows down from upland regions and is undoubtedly of better than average softness. Nevertheless, it contains appreciable amounts of calcium and magnesium carbonates that would form insoluble curds with soap and impart to white clothes that unwanted discoloration dramatized by copywriters as "tattletale gray." Consequently, all the water is filtered through sand, and then the objectionable carbonates are removed through absorption by zeolite in a Permutit system.

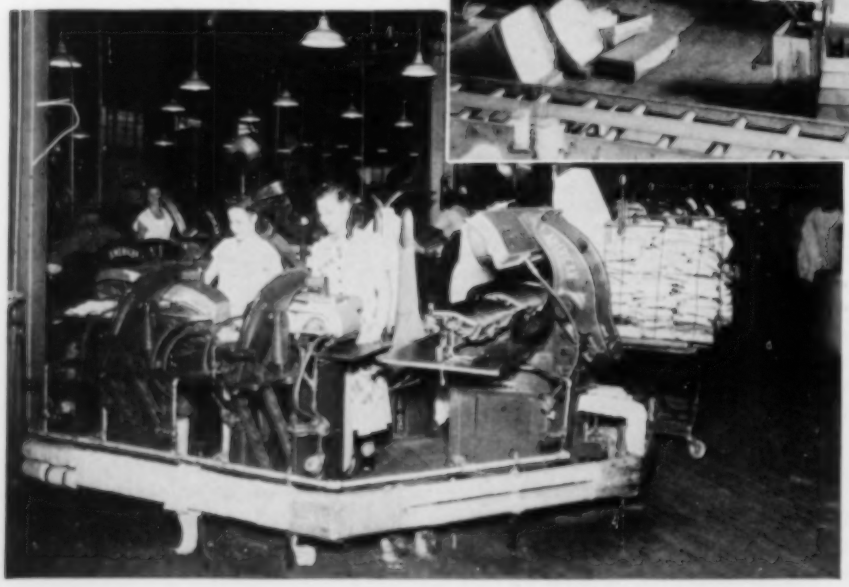
The job of treating the water is a sizable one, for the laundry consumes approximately 500,000 gallons daily. Since all of it is returned to the river it must again be treated to get rid of the contaminants it has absorbed in the course of the operations. When it reënters the stream it is pure enough for fish to live in. The softened water well-nigh completely dissolves soap and other washing materials and enables them to do their work to the fullest possible extent. Incidentally, the soap used is compounded by the manufacturer to give the best results with the water available.

The laundering operations are organized along accepted factory lines. Soiled clothes start on the top floor of a 3-story building and move progessively to the ground floor, where the packages are loaded into trucks. During the journey they are rarely lifted by human effort, instead they travel on conveyors of various types, some of which are exceedingly ingenious. Combined, they are more than a mile long, and many are constructed in the plant's own machine shop.

One of the things that intrigues the lay visitor is the system by which laundry is kept from going astray. The average household bundle is made up of articles of different kinds, each of which must be treated in its own way. Yet all must be brought together again and delivered in a single package. This necessitates tagging them for ready indentification throughout the processing period. The first step is to weigh the bundle intact, as this is required by state law. A sorter separates the wash into the various classifications, which normally include: white goods, light-colored goods, dark-colored goods, silks, and woolens and socks.

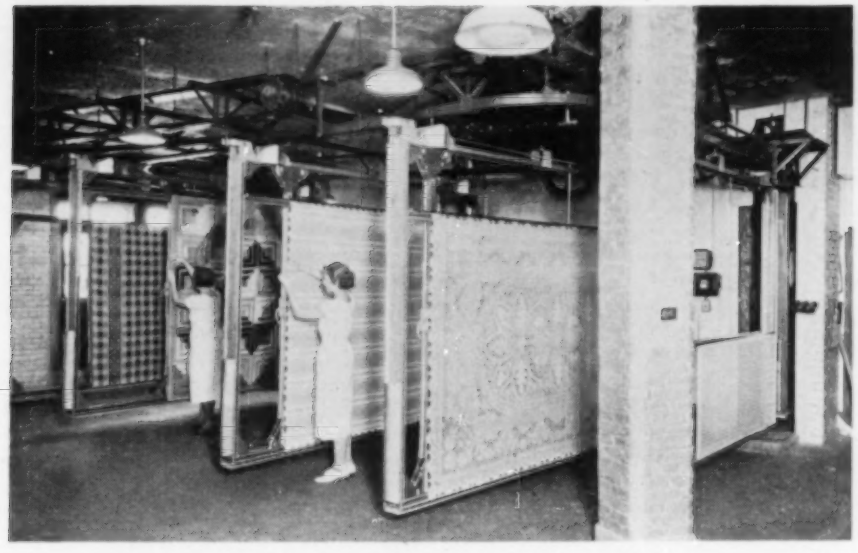
The wash is assigned a number, which appears on five metal disks with center holes keyed so as to fit exactly over a similarly numbered 6-inch metal bar that is rectangular in section. Each of the lots—the laundry calls them separations—is enclosed during washing in a mesh bag or net to which one of the metal disks is pinned. The bar, with any unused disks on it and with the address tag attached, goes to the assembly department. As a separation arrives there, the disk is removed and put back on the bar. When all five are again in place, all separations are accounted for. No error





IRONING FLATWORK AND SHIRTS

Sheets and similar flat pieces (above) pass through temperature-controlled, steam-heated rolls that press without any rubbing action. Each piece is hand folded. Work reaches the department in boxes via the inclined chute at the upper right and leaves on a conveyor, part of which is visible at the bottom left. The other picture shows one of the fifteen shirt-pressing units where five finishing operations are performed on each garment. Sleeves are shaped on the vertical metal form behind the girl in the center. All the other parts are pressed on the air-operated machines.



SPECIAL HANDLING

Curtains, bedspreads, and similar pieces that cannot be satisfactorily ironed are fastened in adjustable frames without the use of pins or hooks. Suspended from an overhead conveying system, they travel through a drying room.

can be made by misreading the number on a disk because the latter fits only the bar stamped with the same number. This system suffices for laundry other than wearing apparel that is to be finished.

Where ironing is required, individual pieces are tagged with metal pins or clip tags by a procedure similar to that just described. When all the markers affixed to the separate articles constituting a particular wash have been reassembled, it is known that that bundle has been finished. It is wrapped and the address ticket is attached to the package ready for delivery. The latter system applies to everything but men's shirts. These are removed from a bundle by the sorter, and the customer's serial number is marked on the inside of the neckbands and a small numbered clip tag is secured to the tail of each shirt. As in the case of the metal disks, these tags fit only the bar with their number on it, so no mistakes can be made when they are detached from the garments at the assembly point.

Clothes are washed in a machine consisting of a cylindrical, horizontal drum and of an inner cylindrical cage which turns slowly. The direction of rotation is reversed every few revolutions, thus causing the cleansing solution to flow back and forth through the wash, thus eliminating any rubbing action. This, plus the fact that the pieces are held together in nets, insures that they will not be subjected to straining or pulling. There are fifteen of these units, and each one holds 400 pounds of clothing, dry weight.

All operations in the washing cycle are automatically timed by an indexing mechanism which, when set, takes over and eliminates any errors that might be caused by manual control. Water, at the specified temperature and in proper quantity, is run in and drained at specific intervals during the washing and rinsing periods. Supplies—meaning detergents, soap solutions, bluing, and in some cases starch—are likewise introduced exactly on schedule. The treatment naturally differs with the character of the goods—the water temperature, the amounts and kinds of soap and chemicals, and the time of washing being such as to produce the best possible results.

Blankets, for instance, are washed by a special process in which the water temperature does not exceed 95°F., and they are guaranteed against shrinkage. White goods are washed for 45 minutes during which the water is changed ten times. After an initial soaking of five minutes in water, soap, and detergent, they are given three successive soapings of five minutes each. Fresh water and soap are added each time, and with the final change a stain remover is put in. Four rinses—three hot and one cold—follow, after which a chemical is introduced to neutralize any soap particles that might remain. The final element added is bluing.

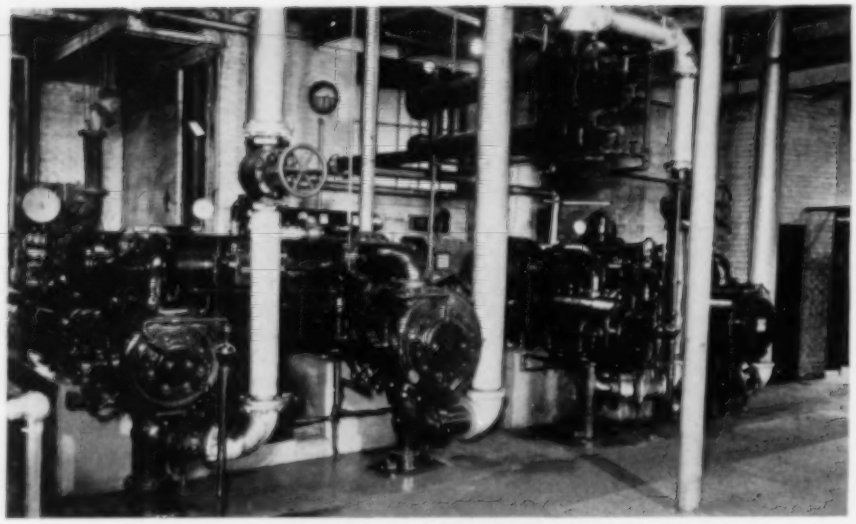
From the washers, the goods are transferred to huge perforated metal containers that are picked up by a hoist running on an overhead monorail and moved to a centrifugal water extractor. There they are whirled at the rate of 750 rpm. for eleven minutes and emerge dry enough for ironing. Washers and extractors are made of noncorrosive, easily cleaned Monel metal.

The finishing routine and facilities vary, of course, according to the nature of the individual pieces. Flat work is ironed by passing it between rolls which, being heated by steam, cannot attain a scorching temperature. The action is that of pressing, no friction is brought to bear. Exceptionally fancy articles may be ironed by hand. Socks and stockings are dried on forms of the right shape and size. Turkish towels are dried in tumblers through which flow currents of warm air, a treatment that fluffs them and bring up the nap in a way that cannot be accomplished by hand laundering.

Most wearing apparel, other than shirts, is finished in the "prim-press" de-

SHAMPOOING AN ORIENTAL RUG

As the rug moves slowly with the revolving cylinder, brushes pass back and forth over the carpet, cleaning it progressively in strips with a soapy solution fed to them. On the other side of the cylinder the soap is rinsed off with clear cold water. The treatment does not affect dyes. The shampooed rug is elevated to the floor above, where it travels in hanging position through a drying compartment.



AIR COMPRESSORS

These two Ingersoll-Rand 125-hp. machines supply the compressed air that is indispensable to the plant's operations. An aftercooler, that serves to remove moisture from the air before it is distributed to the various departments, is suspended above the compressor at the right. It is believed that this laundry uses more compressed air than any other establishment of its kind.

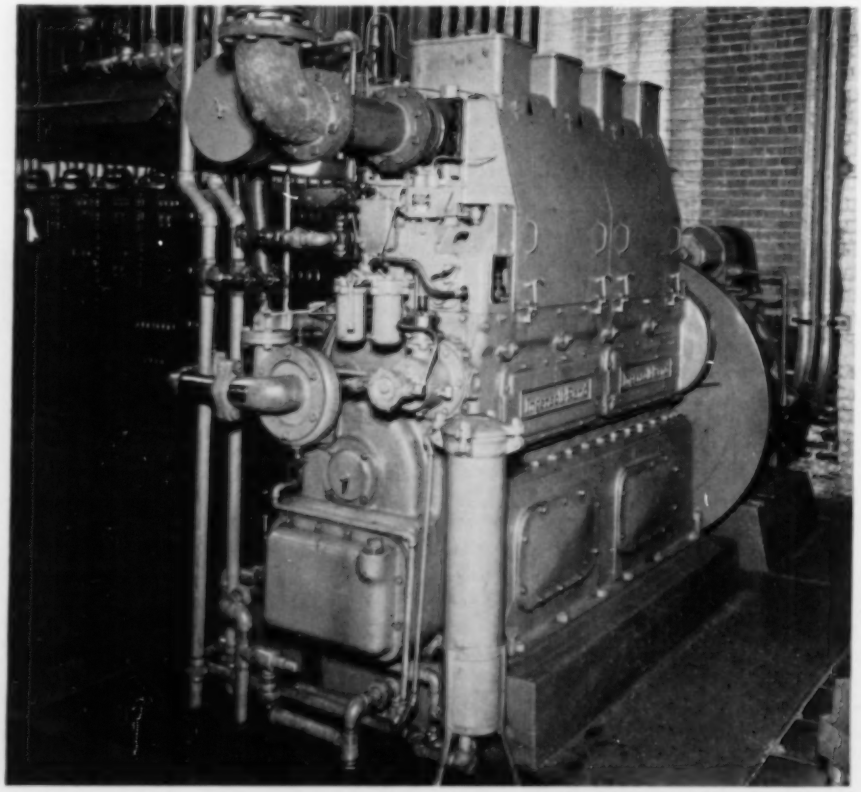
partment. This is made up of a number of units, each of which has four presses that consist essentially of a stationary ironing board and of an upper member that is hinged to it at the back and comes down to meet the board. Pressure is applied and maintained until the operator releases it by means of an air cylinder and piston working through a lever and arm connection. Moisture for pressing is introduced in the form of steam.

Shirts are finished on machines generally similar in construction and action to the prim presses. The sequence of operations involves the following five steps: Each sleeve is smoothed by drawing it over an upright tapering metal form of elliptical cross section. Steam heat applied inside the form does the drying, and edges at either side crease the sleeve lightly as a guide in folding the garment. The latter then passes successively to three presses, each designed to finish a particular part: collars and cuffs, bosom, and body, in that order. In the last machine the shirt is folded around a cardboard insert, the collar is drawn around a cardboard support, and a paper band encircles the garment to keep it intact. No pins are used.

Because large quantities of steam are required for heating water and roll ironers, moisturizing garment presses, etc., it is customary for large laundries to maintain boilers and to generate their own power. This is the practice at the Little Falls establishment. Each of its two boilers, only one of which is used at a time, develops 50,000 pounds of steam an hour at 150 pounds pressure. Approximately half of it serves to operate a General Electric 1000-kw. turbogenerator. Bleed steam from this unit, at one pound pressure, is used for heating water. The remainder of the steam from the boilers is reduced to 100 pounds pressure and piped to laundry equipment and also to the drying room through which rugs pass after they are shampooed.

Two old Hamilton Corliss steam engines of 42-inch stroke, each driving a 400-kw. generator, formerly supplied the plant with power and now serve as standbys, there being no outside power connection. The most recent acquisition is an Ingersoll-Rand oil-engine generator set. This consists of a 300-hp. Type S oil engine direct-connected to a General Electric 200-kw. generator which delivers 2-phase, 60-cycle current at 240 volts. This unit replaced an older diesel generator set and is operated at night and week-ends and holidays to furnish light for the buildings and power for motors on essential services, time clocks, as well as tools for plant maintenance and garage and machine-shop work. It runs an average of 50 hours a week.

Compressed air is an important medium of power, and company officials believe no other laundry applies it so extensively. In addition to operating the scores of presses and controls on automatic washers, it is used in the garage, which makes all truck repairs even to rebuilding engines, and for operating tools in general plant maintenance. Air power is supplied by two Ingersoll-Rand 2-stage machines, each driven by a 125-hp. synchronous motor. The compressors have a combined capacity of around 1100 cfm. and discharge at 80 psi. pressure, which is reduced for some of the plant applications.

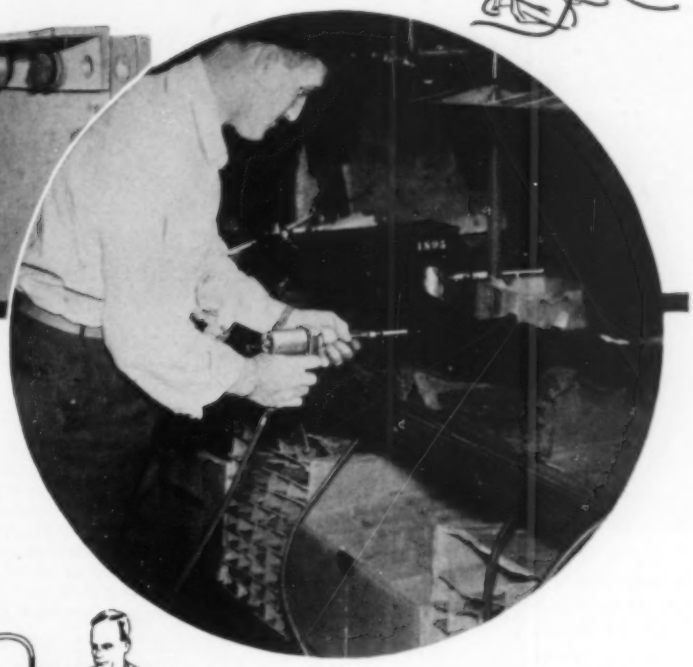


OFF-PEAK POWER GENERATOR

The laundry operates nine hours a day five days a week, during which time its power is obtained from a 1000-kw. turbogenerator. At night and week-ends, the current needed for lighting, maintenance work, and other purposes is supplied by this diesel-engine generator set. It consists of an Ingersoll-Rand 4-cylinder, 300-hp. engine driving a General-Electric 200-kw., alternating-current generator.

Saving Money with Air Power

Allen S. Park



SAVE MONEY AND EFFORT

The impact wrench has probably done more to increase the rate of industrial production and to lighten labor than any other small tool of recent introduction. It converts the power of a driving motor into rotary impacts that are transmitted to a socket with more turning effort than that offered by any other portable wrench. Made in various sizes, the smallest of which weighs less than 1½ pounds, it has been adopted for hundreds of nut-running and similar jobs. The smaller sizes are especially helpful in speeding up the assembly and subassembly of machines and instruments. At the right is pictured a 3-pound Size 502 wrench, fitted with a quick-change chuck, driving ¼-inch machine screws on an assembly bench. Its use in this instance has eliminated a tapping operation that was previously required to remove paint from screw holes. The other view shows a shipyard worker removing nuts from ¾-inch bolts in a floor frame preparatory to riveting.

IT IS generally conceded that the American standard of living has been built up through the application of technology to all forms of industrial endeavor. By enabling men to increase their productiveness, machinery has raised wages and at the same time reduced manufacturing costs. The buying power of an hour's labor is greater here than anywhere else. As a result, this country leads the world in the per capita ownership of automobiles, radios, washing machines, refrigerators, bathtubs, and all the other conveniences and luxuries for which people yearn. We have more telephones and electric lights per family than other nations, and our children go to school longer than those in other lands. In short, the abundance of wanted things that goes to make up what we call the American way of life is the direct outcome of our system of large-scale production through the intelligent harnessing of power. In our factories and mines, and on all kinds of construction jobs, mechanical energy has largely supplanted human muscles.

Industrial activity is a barometer of national prosperity. Anyone who doubts this has only to recall conditions during the 1930 depression years. Millions of men were working with their hands on WPA projects, but their pay envelopes were very thin. As factories resumed or increased operations things got better for everybody, employers and employees alike. It is apparent, therefore, that the time has passed in this country when manual methods will support us at our accustomed scale of living. Man's productiveness must be multiplied by mechanisms if he is to prosper.

In an economy where muscular power predominates, an inflationary period increases the cost of manufacture and construction to such an extent that all activity gradually slows down and eventually stagnates. A nation of hand workers soon finds itself unable to compete with its more mechanically minded neighbors. Its external markets dry up, and it is reduced to trading within its own borders. Like an animal that holes up for the winter, it must live on its own fat, and generally there isn't much fat available.

Even in a country such as ours, an era of rising production costs brings serious problems, but our mechanical ingenuity and flair for organization enables us to cope with them. Confronted with such a situation, American industrial management searches for ways to put the brakes on further increases by instituting less expensive methods of performing essential operations. Since it cannot change labor and material costs, it usually turns for a solution to mechanical aids that will augment the productivity of manpower. The answer may be found in an increase in the efficiency of existing equipment or in mechanizing hand work by means of power tools and devices.

Fortunately, the firms that manufacture machinery and tools are alert to the problems industry is facing and, in times such as these, come forward with new or improved apparatus that can be used to advantage. Also, being thoroughly familiar with the fields they serve, they are quick to perceive and point out where their standard equipment can be applied profitably by their customers, even though that may not have been the case under more normal conditions. And progressive business management is always willing, even glad, to learn of such cost-cutting equipment. It is especially receptive right now when it is making every effort to hold its prices at prevailing levels in the face of continually rising expenses.

A concrete example of what we are writing about is an Air Power Campaign currently being conducted by Ingersoll-Rand Company to inform all branches of industry how pneumatic tools in particular, and compressed-air equipment in general, can be gainfully employed under present conditions. Mindful that "seeing

PNEUMATIC TIME SAVERS

Small pneumatic tools, many of them developed to help industry's wartime production program, have become standard equipment for countless factory operations. Their lightness and ease of handling make them especially suitable for use by women. These pictures show screw drivers weighing only 19 ounces on typical jobs. The girl at the left is running a nut on one of the bolts by which electrical leads are held in contact with insulating brick in an automatic waffle iron. The tool torque is capable of the close control necessary to prevent breaking the brittle brick. The three operators pictured above are driving 3/8-inch wood screws that hold clock movements in their cases. Adoption of these tools reduced the labor cost for each clock case two cents and saved their cost in ten days.

is believing," Ingersoll-Rand has taken the direct approach by offering to make a survey of any plant and then to demonstrate where air power can effect worth-while economies. Needless to say, hundreds of concerns are taking advantage of this offer, and others will undoubtedly do so when it is brought to their attention.

The campaign is based on simple arithmetic. Accepted statistics show that wages have risen on an average 118 percent since 1939. The selling price of Ingersoll-Rand air tools has meanwhile gone up only 45 percent. Consequently, the earning power of the tools has increased proportionately. Time and cost studies of numerous representative operations have disclosed that pneumatic equipment that saved enough time a few years ago to pay for itself in 30 days will now do so in only eighteen days. In view of these findings, the company contends that every industrial plant, regardless of how thoroughly mechanized it may be, should reëxamine all its operations to determine where labor-aiding tools and machines can bring about worth-while savings under today's changed conditions. The theme of the campaign is that production can be increased and unit costs lowered by:

1. Replacing worn-out tools with new ones.
2. Putting more suitable tools on the job.
3. Using air-powered equipment where mechanization formerly would not pay but where it will be profitable now because of higher labor costs.

Research that preceded the campaign revealed that some rather startling economies could be effected by the use of air power. Hundreds of applications of pneumatic tools, rock drills, and allied equipment were studied and a voluminous file of "case histories" was assembled. A few typical examples follow:

A railroad shop formerly needed seven hours of hand labor at $1.40 an hour to remove screws from diesel-engine side sheets, the cost per job being $9.80. Today, the same work is done with a pneumatic impact wrench in one hour at an expenditure for labor of $1.40. The difference of $8.40 an hour paid for the $119 tool in fourteen hours.

An equipment manufacturer was doubtful that air-powered screw drivers would save time on a particular set-up. When a demonstration was arranged the tools did the job in one-fifth the time normally required. On the strength of the showing he purchased 46 at an outlay of $3680. They paid for themselves in ten days.

Three structural-steel workers normally spent two days fabricating a 60x5-foot steel beam by bolting the parts together by hand. With a pneumatic impact wrench the same men completed the operation in one hour. The tool paid for itself in four hours of use.

A chemical plant, seeking to improve upon its method of transferring a fine, light, dry soda compound to screw conveyors, bought a drag scraper and an air hoist to operate it. The investment—$759—was liquidated in 60 days.

A mining company drilling blast holes in very hard ground with steel bits and rods found that their average cost was 46.4 cents per ton of material broken. Carset (carbide-insert) bits were adopted and cut down the steel-and-bit cost to 27.8 cents per ton of ore drilled. In addition to this direct saving of 40 percent, auxiliary economies are effected by reducing the air consumption, increasing the service life of drill parts, and drilling more feet of hole per shift than formerly. Moreover, drill runners prefer the new equipment to the old.

Although the campaign is emphasizing pneumatic tools because they are widely utilized in manufacturing plants, Ingersoll-Rand contends that its theories apply with well-nigh equal force to other types of air-powered units such as rock drills and paving breakers, and even to air compressors themselves.

Since prospective purchasers are primarily interested in knowing what power equipment will mean to them in dollars and cents, Ingersoll-Rand is presenting its case by setting forth the length of time its various products must be used

in representative applications in order to repay their purchase price. This yardstick is known in industry as "payout time." Many studies have been made by large companies in an effort to determine the acceptable payout time for various classes of machinery, but no figures have been agreed upon. However, it is unquestionably good business to buy any machine that will save enough to return its cost in one or two years. Actually, as the previously cited case histories reveal, there are numerous instances where air tools pay out in a matter of hours or days.

So far as rock drills are concerned, no comparison can be made between hand and machine methods in the fields of mining and contracting because they have employed mechanical drills almost exclusively for many years. Even so, modern rock drills are so much more efficient than those produced only a few years ago that a strong case can be made in favor of discarding outmoded equipment now in service.

In the industrial field, there are thousands of plants in which floors and pavements are occasionally torn up, walls cut through, etc., in the course of maintenance operations or the installation of new machinery. A great many of these establishments still do this demolition work by hand in the belief that they don't have enough of it to warrant buying air tools. Actually, however, it can be shown that a paving breaker will pay for itself in a very short time. It is generally recognized that one man can accomplish as much with a paving breaker as twenty men with hammers and chisels.

DRILLING ROCK THE MODERN WAY

Air-powered rock drills long ago supplanted hand drillers on construction jobs, thereby greatly reducing costs. The effectiveness and economy of mechanical drilling are being increased continually not only by improving the machines themselves but also by mounting them so that they will work to best advantage and can be readily moved. The latest contribution to fast drilling is the detachable bit with tungsten-carbide inserts. The picture shows Ingersoll-Rand wagon drills powered by portable air compressors and working on a new highway in Montana.

Since the hourly rate for common labor in the metropolitan areas is now around $1.50, it costs $30 to do by hand what one man can do in an hour with a paving breaker. Assuming that the operator receives $2, the indicated saving is $28 an hour. On this basis a modern PB-6, which represents an outlay of $280, will pay for itself in ten hours. Consequently, the cost can be written off in one year even if the tool is used only a little more than eleven minutes per week.

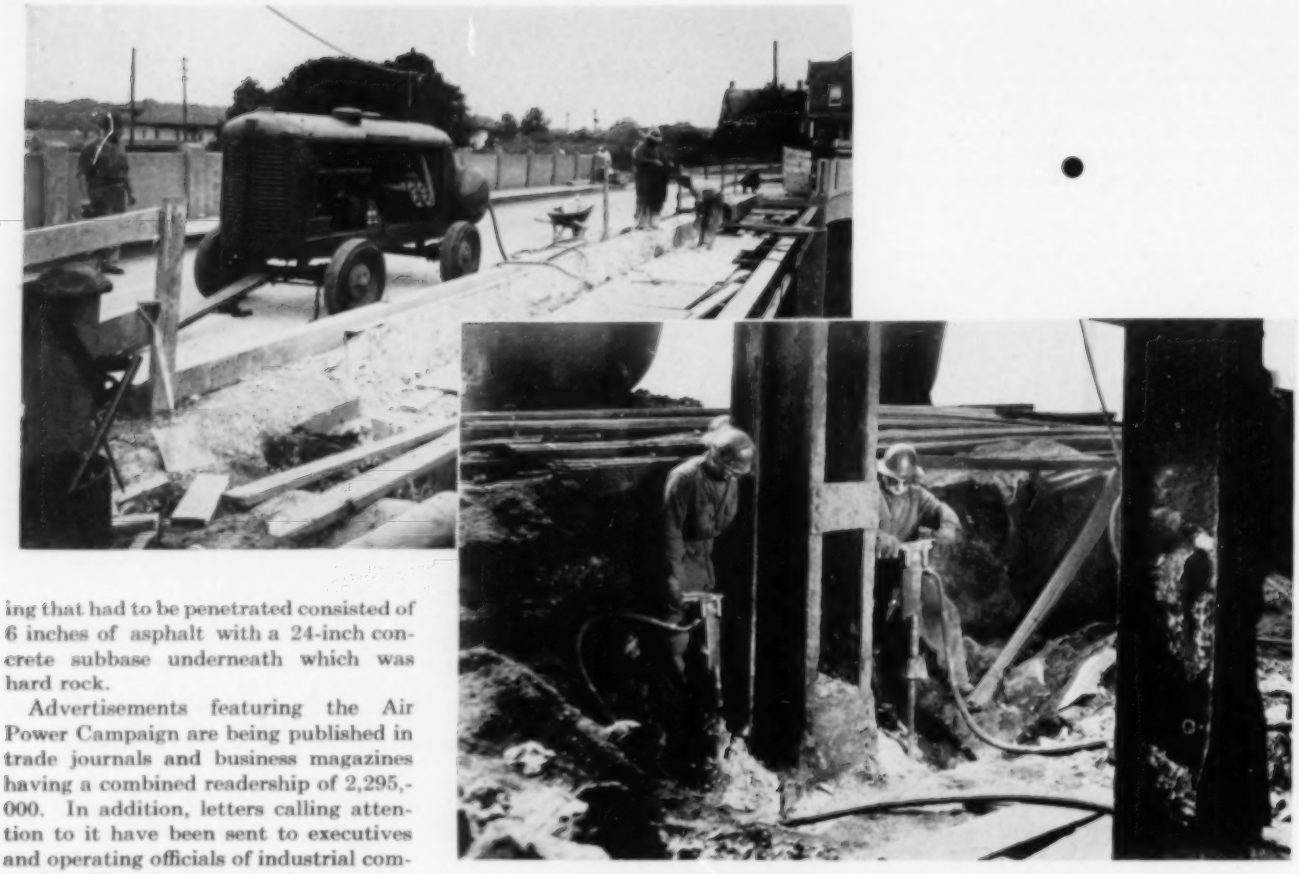
Most industrial plants have a supply of compressed air with which to run a paving breaker. If a portable unit had to be purchased for that purpose the total investment would be around $2000, including the tool. Even then, however, the outfit could earn its cost in 71½ hours of use, and the compressor would, of course, be available for various other services.

There is nothing new about this sales approach so far as it concerns portable compressors and the tools they ordinarily operate. Twenty years ago, when portables were somewhat of an innovation and when wages were relatively low, Ingersoll-Rand sold these machines by presenting data on the savings that could be made by using them in place of hand-labor methods. At that time it published and distributed 165,000 copies of a booklet, "100 and 1 Ways to Save Money" that gave specific cost comparisons between manual and mechanical drilling and demolition work of different kinds. Since 1928 wages have gone up so much more than the selling price of the equipment that it is even more economical to do these jobs with air power now than it was then.

To illustrate this point there is given on page 296 one of the examples from the booklet, together with an additional column to bring the figures up to date. The example was based on the actual experience of a utility company that turned from hand to power methods for opening up street excavations. Some of the pav-

SLUSHER HOISTS BOTH TRANSPORT AND LOAD

Most back-breaking jobs have disappeared from underground metal mines. Much of the ore and rock that were formerly shoveled are now moved a considerable distance by hoist-operated scrapers and loaded by gravity. Innumerable set-ups are possible to meet varying conditions, and hoists are available in a wide range of sizes. Shown here is a double-drum unit furnishing power for scraping magnetite iron ore from a subdrift in a mine in New York State.



PAVING BREAKERS SERVE IN MANY WAYS

One man with a paving breaker can tear up as much concrete or similar material as twenty men with hammers and chisels. The view at the top shows a typical demolition job on a bridge-widening project, with operating air coming from a portable compressor. In addition to being used in regular maintenance work in industrial plants, paving breakers are saving time and money on special applications. The two PB-8 machines pictured just above are breaking up slag that had accumulated on the loading floor of an open-hearth furnace in a steel mill.

ing that had to be penetrated consisted of 6 inches of asphalt with a 24-inch concrete subbase underneath which was hard rock.

Advertisements featuring the Air Power Campaign are being published in trade journals and business magazines having a combined readership of 2,295,000. In addition, letters calling attention to it have been sent to executives and operating officials of industrial companies. The offer to make plant surveys is worded as follows:

"At no cost to you, I-R field engineers will make a job study with actual air-tool performance tests on your operations in your plant. You can use the equipment yourself, try it in any way you like, keep your own time and cost records. Then you will know how much it can save you and how soon it will pay for itself on your jobs."

As one phase of the plant surveys, Ingersoll-Rand representatives are stressing the wisdom and economy of eliminating certain abuses of compressed-air systems that are more or less prevalent. The commonest of these is said to be overloading of air compressors, in consequence of which pressure delivered to tools and machines is too low for them to do all the work of which they are capable. As a result, many establishments are not getting the fullest possible savings from air power. In this connection it is pointed out that an electrical engineer would not put a motor on a wiring system that is deficient in voltage, and that no operating man would attempt to run a steam turbine without having adequate boiler capacity to serve it. There is a tendency, however, to add to the number of air tools and appliances on a line without also increasing the air supply to keep the pressure at the point where it should be. Actually, this is false economy. Since the efficiency of air-powered mechanisms drops off sharply at reduced working pressures, it is erroneous for an establishment to assume that it cannot afford additional compressor capacity. The truth is that failure to maintain pressure is wasteful and extravagant.

Pertinent is a case cited in *Compressed Air Handbook* published by Compressed Air and Gas Institute. Tests show that pneumatic grinders will do 37 percent more work at 90 psi. pressure than at 70 psi. Assuming that only one-third of this potential gain is actually realized, detailed figures prove that when the pressure is increased to that extent there is a net saving of $33.29 per day when twenty grinders are operated by an $8500 compressor plant. If another compressor had to be bought to meet the additional demand, it would cost $2200. The daily saving of $33.29 thus made possible would pay for the machine in 68 working days.

HAND METHOD VERSUS I-R PAVING BREAKERS

Cost By Hand	1928	1948
Number of men required to do work of two paving breakers and two operators	40	40
Average wage per day	$4.00	$12.00
Total cost per day	160.00	480.00
Cost By Machine Method		
Cost of two paving-breaker operators per day	8.00	24.00
Overhead on two paving breakers and compressor	16.96	34.00
Total cost (labor and overhead)	$24.96	$58.00

AIR POWER
The Key to Lower Production Costs

Water-Vapor Refrigeration

A Comparatively New Method of Producing Refrigeration at Moderate Temperatures Has Many Applications

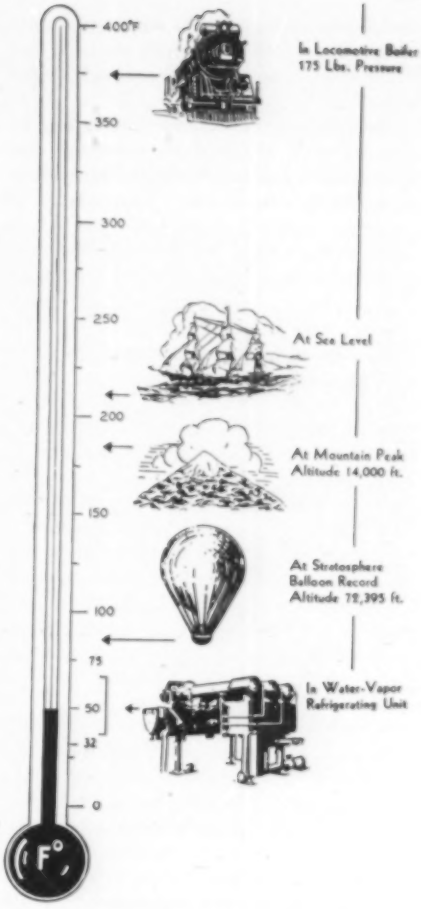
H. R. Havemeyer

MOST persons think of refrigeration in terms of subzero temperatures, but there are a surprisingly large number of applications that require refrigeration above the freezing point of water. Installations of the latter type are used for air conditioning, for comfort cooling, and for a wide variety of industrial purposes. One fairly recent and highly successful means of producing such temperatures is by the evaporation of water in steam-jet coolers.

Steam-jet water-vapor refrigeration, as the method is officially termed, is based on a principle long known to travelers in desert and semiarid regions. Many of them carry their water supply in bags that are porous enough to allow a small amount continually to wet the outer surface. Evaporation of some of this water, which is absorbed by the dry desert air, draws heat from the water in the bag and cools it. Steam-jet units do the same thing but in a different fashion. Lacking the dry desert air, the cooler carries out the process in a chamber that is kept under a vacuum. By thus reducing the pressure in the chamber some of the entering water draws heat from the remaining, larger quantity of water and flashes into vapor. The chilled water is then withdrawn and circulated to wherever its cooling effect is desired.

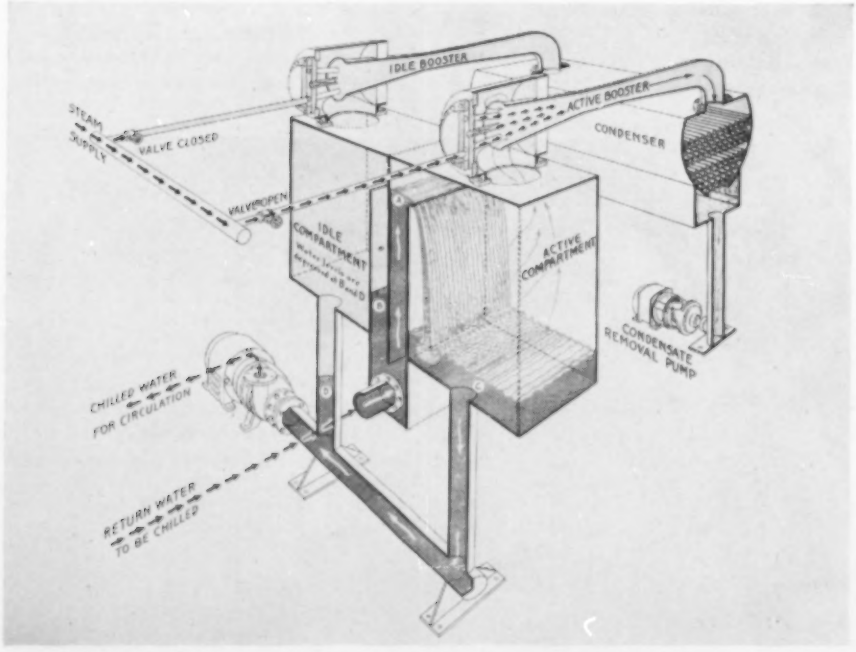
Water-vapor units differ considerably in design and construction from the ordinary type of commercial refrigeration systems. No chemical liquids or gases are required, water being the only refrigerant. Furthermore, the water evaporated to give the refrigerating effect is not normally reused. High pressures are not needed, all pressures in the unit proper being below atmospheric. The only operating requirements are steam for evacuating the flash chamber, and cooling water for condensing the spent steam and the water vapor.

Essentially, the steam-jet cooler consists of an insulated flash chamber or evaporator, a steam-driven booster ejector, and a condenser. Water to be cooled is instroduced into the flash chamber, which is under a vacuum induced by the booster ejector. Part of the water vaporizes and is drawn from the chamber by high-velocity steam issuing from the nozzles of the booster ejector. The mixture of steam and vapor is then compressed by the booster and discharged into the condenser, where it is liquefied by cooling water. The chilled water remaining in the flash chamber is circulated through



WATER BOILING POINTS

Pressure determines the temperature at which water will boil. Variations in boiling point under different pressure conditions are shown above. In the steam-jet water-refrigeration unit water can be made to boil at a temperature as low as 32°F., which is normally water's freezing point.



HOW WATER-VAPOR REFRIGERATION WORKS

When water flows into the active evaporator compartment, a small portion of it is evaporated because of the vacuum maintained there by the action of the steam-jet booster. The heat required for evaporation is extracted from the remaining water, which is cooled in consequence. The vapor is removed by the ejector and discharged into the condenser, where it and the steam are liquefied and then recirculated. The chilled water is circulated to wherever its cooling effect is used and returned to the evaporator to be cooled again. The apparatus shown has two flash chambers, which permits increasing or decreasing its refrigerating capacity in accordance with load variations. The four water levels indicated by letters A, B, C, and D are caused by the pressure difference between the evaporator and condenser vacuums.

the refrigerating system where it exerts its cooling effect and picks up heat before being returned to the evaporator for recooling.

Either barometric or surface-type condensers may be used to condense the spent steam and water vapor, depending upon service demands. The former is generally utilized where low first cost is desired and where condensate recovery is not important. It condenses the steam and vapor by bringing them in direct contact with the cooling water. The discharge is wasted or may be applied to advantage in processes requiring large quantities of warm water. A feature of this condenser is that dirty cooling water, which would foul the tubes of surface-type condensers, can be used. Because the water drains by gravity from the barometric condenser, which is under a high vacuum, a 34-foot barometric leg must be provided, making the over-all height of the installation in the neighborhood of 50 feet. But as this type of equipment is usually located out of doors, height is not a problem.

Surface-type condensers are used wherever condensate recovery is essential or where a barometric condenser cannot be set up because of lack of headroom. Units of this kind are generally installed indoors. Cooling water is circulated through a large number of small tubes around which the hot vapor and steam are forced, the condensate on the outer surfaces of the tubes being collected and sent back to the evaporator chamber. Losses are compensated for by the periodic addition of make-up water.

Because both types of condensers operate under a vacuum, it is necessary to incorporate air-removal equipment. This usually takes the form of a small, 2-stage, steam-jet air ejector which requires only a small percentage of the steam and cooling water used by the booster ejector and condenser. This device serves another purpose—it withdraws air from all parts of the installation when it is first started up and before the booster ejector is turned on.

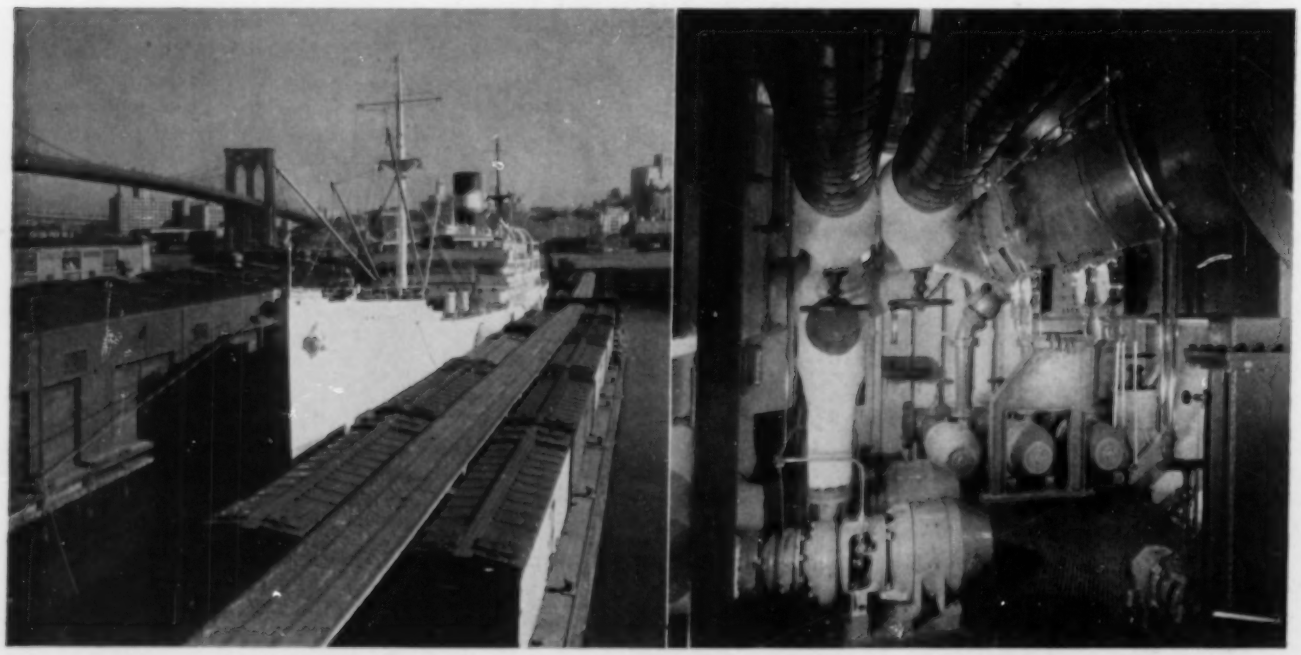
The amount of water evaporated to obtain the desired cooling effect is approximately 1 percent of the quantity circulated for each 10° of refrigeration. For example, in a commercial unit, about 2.26 gpm. will be evaporated if 240 gpm. at 60°F. is introduced into the flash chamber under a pressure of 0.363 inch of mercury absolute (29.637 inches of vacuum) and if the water is to be cooled to 50°. In an hour's operation, the vaporized water will absorb heat equivalent to 1,200,000 Btu's.

Refrigerating capacity is generally expressed in terms of tons of refrigeration, one "ton" corresponding to the extraction of 288,000 Btu's. This equals the amount of heat required to melt a ton (2000 pounds) of ice in 24 hours. Introducing the time element, one ton of refrigeration is equivalent to 12,000 Btu's per hour. At that rate, the unit operating under the conditions mentioned in the preceding paragraph is capable of producing 100 tons of refrigeration per hour. The pressure maintained in the booster condenser depends upon the temperature of the available cooling water. At normal temperatures, it will vary between 1½ and 2½ inches of mercury absolute (28.5 and 27.5 inches of vacuum, respectively).

Because the capacity of a steam-jet ejector at a given suction pressure is wellnigh constant and is not appreciably affected by changes in the quantity of steam used, it is not practicable to regulate the refrigerating capacity of a unit by throttling the steam flow to the booster ejector. For this reason, an installation intended to carry a varying load is built with multiple booster ejectors that operate in parallel. To reduce the refrigerating capacity it is necessary only to close the steam valve to one or more of the booster ejectors.

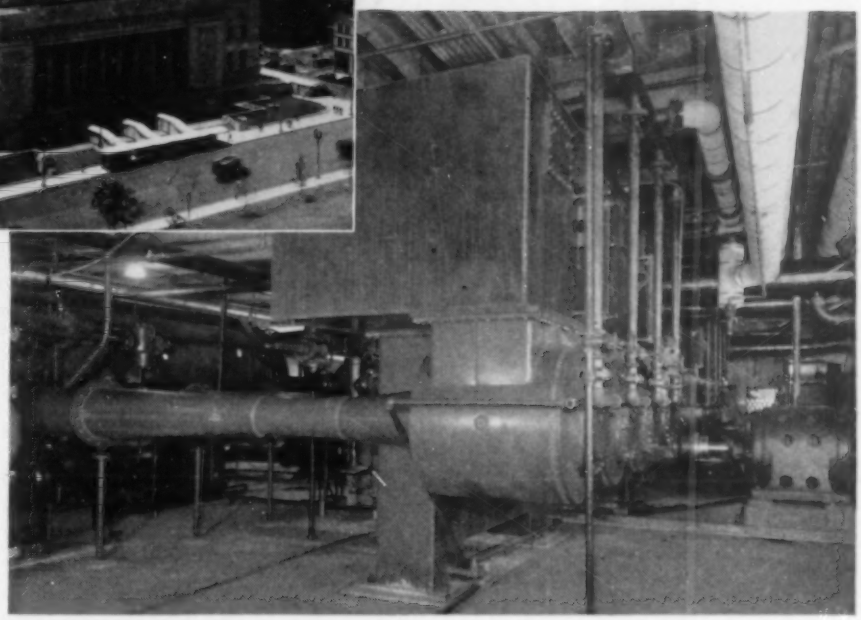
When a single-booster refrigerating system is run at partial load, it is possible to save on steam by intermittent operation of the booster. This may be done manually or by means of automatic controls, which permit maintaining the chilled water within 1°F. of the optimum operating temperature. A thermostat in the discharge line of the unit actuates a relay through which compressed air is admitted to a pneumatically operated valve in the booster steam-supply line.

Steam-jet water-vapor refrigerating systems possess many advantages over conventional refrigerating equipment. Because there are no moving parts, except in the centrifugal pumps that circulate the cooling and chilled water, upkeep cost is low. Control and operation



KEEPING BANANAS COOL

Ships carrying fruits and other perishables are refrigerated to keep their cargoes from spoiling. Shown at the left is the SS "Ampala" of the Standard Fruit & Steamship Company unloading bananas at a pier in New York Harbor. At the right is a view of the Ingersoll-Rand 200-ton steam-jet refrigeration unit on this vessel. The condenser is overhead on the right, and a section of the evaporator is visible at the extreme left. The pumps in the foreground circulate the chilled water through the refrigerating system. Three other ships of the same line are equipped with similar machines for preserving bananas while en route from Central America to northern markets.



AIR-CONDITIONING OF BUILDINGS

Pictured at the left is the Municipal Auditorium in St. Louis, Mo., in which two 600-ton steam-jet coolers (right) supply chilled water to condition the air. Because of limited headroom the units were erected "upside down."

require only the opening and closing of valves in the steam and water lines and the starting and stopping of pumps. With water as the refrigerant, there is freedom from restrictive ordinances governing the use, storage, and transportation of chemical refrigerants. This factor, together with the low internal pressures, makes the units suitable for service at locations where danger from fire or explosion must be reduced to a minimum. The use of turbine drive for the pumps makes for even greater safety.

Steam-jet coolers have a reserve capacity considerably in excess of that of other types of refrigerating systems. For example, a unit with an output of 100 tons of refrigeration at a chilled-water temperature of 50°F. can produce approximately 115 tons with an increase in the chilled-water temperature of only 5°. This reserve is especially valuable where variations in refrigeration requirements may result in changes in refrigeration loads It also permits cooling down quickly to operating temperature when starting up the system.

In addition to reserve capacity, steam-jet coolers have full capacity for life. There is no chemical refrigerant to leak out and cause a drop in refrigerating effect. Flexibility is another feature, for the relative positions of the different parts can be varied so that a unit can be fitted into cramped quarters. The weight of the equipment is moderate, and a heavy foundation is usually not needed.

Steam-jet coolers have a wide field of application in industry. They are used to cool illuminating gas so as to remove tar and water before the gas enters the distribution lines; to separate one or more components from vapors produced by the distillation of liquid mixtures; to refrigerate caustic solutions, lubricating oils, carbon dioxide, compressed air inter- and aftercoolers, and hydrogen or air in the cases of large generators; as well as to chill drinking water, beverages, food, chemical solutions, and distillery mash and slop.

Chemical plants and sulphite paper mills often find it difficult to make acid of the proper concentration during the summer months because warm water does not readily absorb gases. Many of them therefore have steam-jet water-vapor refrigeration units to lower the temperature of the water to 50° at which it absorbs approximately 50 percent more sulphur-dioxide gas than at 75°. One system lately installed in a paper mill cools 144 gpm. of water from 75° to 50°, which is the equivalent of 150 tons of refrigeration at 50° chilled-water temperature.

Plants engaged in the manufacture of paper, synthetic rubber, and other products often use steam-jet refrigeration to cool the rolls between which the material is formed. Water chilled to 50° is circulated continuously through the jackets of the rolls, resulting in a product of uniform quality. The system eliminates seasonal fluctuations in the temperature of ordinary cooling water, which sometimes reaches 85° in summer.

One paper mill recently set up a surface-type unit to chill the rolls on a paper calender. The water is circulated in a closed system, returning to the refrigerating equipment after passing through the rolls. The installation has a capacity of 28 tons of refrigeration at 40° chilled-water temperature. Waste steam at 7 psi. gauge is available, and the cooling water is used for process work after flowing through the condenser. Hence, the principal operating cost is that of pumping the chilled and the cooling water.

Air conditioning and comfort cooling are tasks for which steam-jet units are well suited. The moderate chilled-water temperatures involved enable them to operate efficiently and economically, and their freedom from explosion and other hazards makes them safe for installation in buildings housing many persons.

In the case of comfort cooling, particularly, steam-jet refrigeration offers decided advantages. Many plants require steam for processing and for heating but operate their boilers at reduced load in summer. Several have found it worthwhile to maintain their steam load during the summer months and use the extra steam for comfort cooling. If steam is purchased, it can be obtained at a much lower rate during that season than in winter.

The pharmaceutical, chemical, petroleum, synthetic-rubber, and solvent-extraction industries are equipped with no end of distillation apparatus. The vapors distilled from various fluid mixtures are condensed in a surface-type condenser through which a refrigerated liquid is pumped. Steam-jet units offer con-

REMOVING IMPURITIES FROM GAS

Water cooled by the unit shown here is used to condense tar and moisture so that it can be removed from manufactured gas before it enters distribution lines. The condenser is of the barometric type. The valve at the lower right controls the flow of gas from the holder into the mains.

siderable safety for the condensation of vapors of a volatile or explosive nature.

One of the most promising fields of service for water-vapor refrigeration is on shipboard. Though its marine application is comparatively new, yet it has already proved its value on such passenger liners as the *Queen Mary* and the *Empress of Britain*. It also serves to cool crew quarters and cargo spaces on naval vessels and fruit ships. Because of their flexible construction, steam-jet coolers can be fitted into places that are normally wasted aboard ship. One installation of this type utilizes the tunnel space around the spare propeller shaft, another that between the boilers and the hull, and a third the space aft of the engine room.

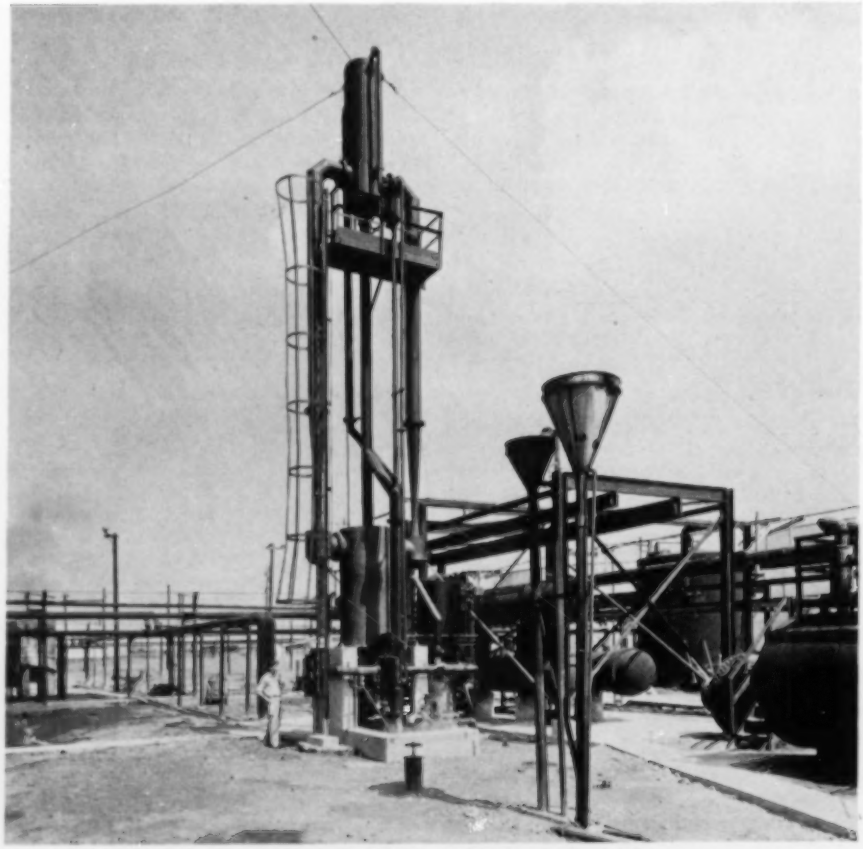
Systems of this kind usually involve a low initial investment by reason of their simple design and absence of moving parts. No skilled operators are needed; in fact, the units may be controlled automatically. Their operating costs will be low if they are properly integrated with other equipment to take steam normally used for heating purposes in cold weather, exhaust steam from auxiliaries, or steam from waste-heat boilers or bleeder turbines. The only outlay in connection with the condensing water is that for pumping it.

Condensation of tar and water in service lines and apparatus of companies engaged in the distribution of natural or manufactured gas often causes operating difficulties. To avoid this condition, the water and tar must be separated from the gas before it enters the system. Because equipment for this purpose is generally located near gas holders or storage chambers, the safety features of water-vapor refrigeration make it well suited for this work.

In the brewing and distilling industries, it is necessary to chill large quantities of mash or wort before it is allowed to ferment. Many plants are hindered in this work by the high temperatures of the cooling water in summer, by limited supplies of water, or by the high maintenance cost of coolers of the double-pipe type. However, as the cooked material contains a considerable amount of water, it is possible to chill it by evaporating some of its moisture content in water-vapor refrigeration units of special design. As the mash is cooled directly there is no fouling of heat-transfer surfaces, with the incidental loss in capacity which is so often the case with tubular heat exchangers. Products that can be cooled in this manner are yeast, sugar, starch, and caustic solutions.

During the summer months, electric plants are frequently forced to operate at reduced capacity simply because the temperature of the water used to cool the air or hydrogen in the cases of the generators is too high to prevent the machines from overheating at full load. Steam-jet refrigeration is an ideal solution of this problem because steam and water are usually available at reasonable cost and only moderate chilled-water temperatures are needed.

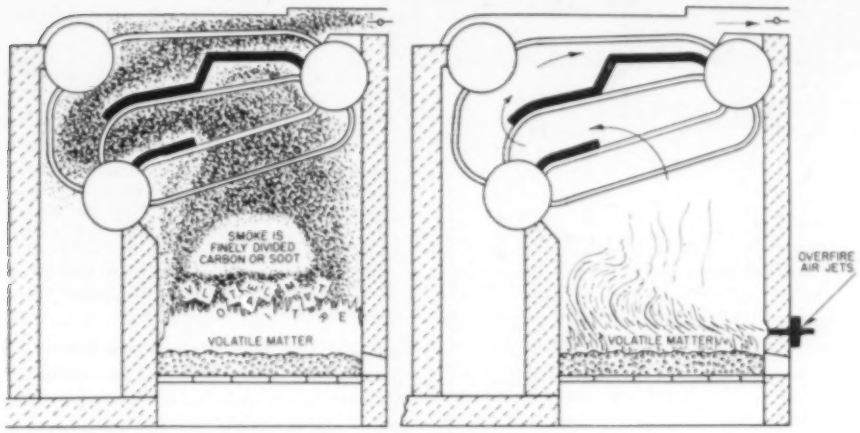
The foregoing examples illustrate a few of the many fields in which steam-jet coolers have done satisfactory work. The list is by no means complete, and new applications are continually being found. In each case, the decision between mechanical and water-vapor refrigeration must be made on the basis of the nature of the load, the type of service, the availability and cost of steam and water, and the first cost of the installation. Where cooling temperatures of 35°F. and higher are required and where sufficient steam and water can be had at reasonable rates, serious consideration should be given to the low first cost and operating economies of steam-jet water-vapor refrigeration.



SERVING AN OIL REFINERY

This outdoor unit, which is equipped with a barometric condenser, supplies chilled water for cooling lubricating and sulphonated oil at a Gulf Coast petroleum refinery. It has a capacity of 133 tons of refrigeration when cooling water to 79°F.

Curbing Industrial Smoke with Jets of Air



CAUSE AND PREVENTION OF SMOKE

When volatile matter distilled from coal during the combustion process is highly heated in an oxygen-deficient atmosphere, it breaks down into smoke-forming carbon or soot particles, as illustrated at the left. When more oxygen is fed into the combustion chamber, as shown at the right, the volatile matter burns and is converted into colorless water vapor and carbon dioxide.

COAL is the world's principal source of heat and power, some 1½ billion tons being burned annually in providing these necessities. In quantity, geographical distribution, monetary value, and industrial importance it ranks among the world's major natural resources. Yet coal is also the source of considerable amounts of smoke and soot that begrime our cities and befoul the air we breathe. The prevention or control of industrial smoke is a problem that is receiving increasing attention from municipal authorities interested in clearing the atmosphere and beautifying their communities.

Smoke is caused when hydrocarbon gases distilled from burning coal are brought to a high temperature in an atmosphere containing insufficient oxygen for their complete combustion. Such an atmosphere frequently exists above the fuel beds of hand- or stoker-fired furnaces. In other furnaces, however, there is adequate oxygen, but it is not uniformly distributed for combining with the hydrocarbons as released from all sections of the fuel bed. As a result, the unburned gases break down into finely divided carbon particles or soot, the constituent of smoke. Because these particles of carbon are extremely hard to burn, the task of smoke abatement is basically one of preventing their formation.

In the past, numerous attempts have been made to insure complete combustion of the hydrocarbon gases present in furnace fireboxes. One of the most successful devices invented for this purpose is the overfire air jet which directs a stream of air, or steam and air, into the zone immediately above the fuel bed of the furnace. The turbulence thus created causes the oxygen and the unburned gases to mix thoroughly, converting the latter into colorless water vapor and carbon dioxide and clearing the stack of smoke in a matter of seconds.

However, this method did not find immediate and widespread adoption for several reasons, even though it gave spectacular results. Early jets were usually makeshift affairs, they were not designed on a scientific basis. Frequently, steam consumption for the quantity of air handled was high, and matting or clinkering of the fuel bed was not unusual because the stream issuing from the jet impinged on the burning fuel. Furthermore, operators often refused to use the jets, for only limited or no attempt was made to reduce or silence the intolerable noise characteristic of an unmuffled steam jet.

In 1942, Bituminous Coal Research, Inc., national research agency of the bituminous-coal industry, began to investigate the use of overfire air jets with a view to establishing their basic design and application principles. The research was conducted at the Battelle Memorial Institute, and studies of factors such as air entrainment with different tube diameters and lengths, steam consumption of various types and sizes of nozzles, flow characteristics, etc., were made under both laboratory and field conditions. The results of this work showed that scientifically designed overfire air jets, properly installed and controlled, could be of great help in the elimination of industrial smoke.

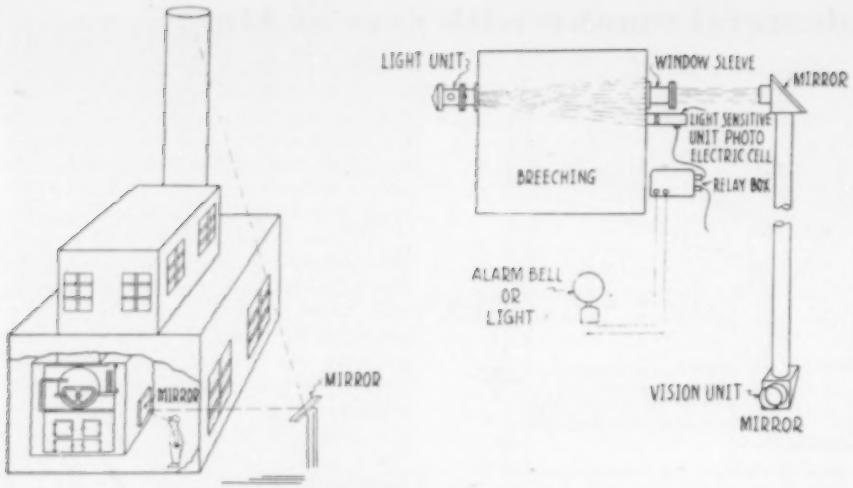
Fundamentally, the overfire air jet is simply a short section of metal tubing inserted in a furnace wall for the purpose of directing a stream of air into the firebox. Air for its operation may be supplied by a motor-driven blower, or the flow may be induced by a jet of steam. Where the latter method is used, the jet must be fitted with a muffler or silencer to prevent it from generating excessive noise. The muffler is generally in the form of a jacket of rock wool or other insulating material and fits over the steam nozzle and entrance to the air tube, thus silencing the sounds caused by steam and air rushing through the jet.

Several jets are usually required for each furnace. They are set in the furnace wall and spaced in such a manner and at such a height as to create turbulence throughout the entire area above the fuel bed without directing their streams of air against the fuel itself. Bridge-wall or side-wall rather than front-wall application is preferred because the jet system is more effective when the streams of air are counter to or cut across the normal flow of furnace gases.

Because furnace conditions may not require continual use of the jets, a means of control must be provided if the installation is to be operated economically. Visual observation of the amount of

EFFECT OF OVERFIRE JETS

Only fifteen seconds elapsed between the taking of these pictures. The one at the left shows smoke belching from the stack of a river boat at Pittsburgh, Pa., a few seconds after eight shovelfuls of coal had been placed in the firebox, which had been in a banked condition for fifteen hours. The other shows what happened as soon as the overfire jets were turned on.



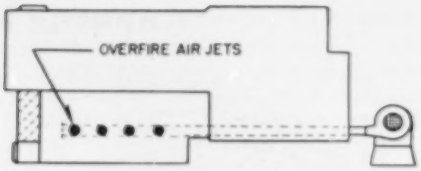
NOTIFYING THE FIREMAN

Jets need to be operated only when smoke is being produced. In small plants an arrangement of mirrors (left-hand sketch) enables the fireman to see when smoke is issuing from the stack. Larger plants usually use a photoelectric system, such as that diagrammed at the right. It will cause a signal bell or light to function when too much smoke is being formed. Or it may be equipped to operate the overfire jets automatically when they are required and also include a visual unit, as indicated.

smoke issuing from the furnace stack is a satisfactory method if the operator is able to view the stack from the firing floor either directly or by the aid of a periscope or mirror arrangement. Where visual inspection is not possible, a photoelectric cell installed in the breeching to the stack will serve to indicate smoke density. Receiving light through the stack gases, the instrument causes a lamp or bell to give a warning signal whenever the light focused on the cell is beclouded beyond a predetermined point by the smoke in the stack. The cell also can be designed to turn the jets on and off as changes in smoke density may necessitate, making the control system fully automatic.

Experiments conducted by staff engineers of Battelle Memorial Institute are evidence of the effectiveness and economy of operation of overfire air jets. Equipment used in the tests included a 100-hp., single-pass boiler fired with a single-retort, underfeed stoker, as well as photoelectric smoke-recording charts and numerous other measuring instruments. Washed, double-screened, size 2x1-inch, highly volatile coal was selected as fuel so that smoke could be created intentionally in the furnace.

Two 24-hour tests were conducted under A.S.M.E. boiler-code practices: one with the jets in service and the other with the jets inactive. The average density of the smoke generated while the jets were in use was 0.4 Ringelmann, as compared with 1.8 Ringelmann without the jets. The jets also reduced the flue-gas temperature from 624 to 586°F., this being attributed to an improved heat-transfer rate because less carbon and soot were deposited on the boiler surfaces. Wattmeter readings gave 0.72



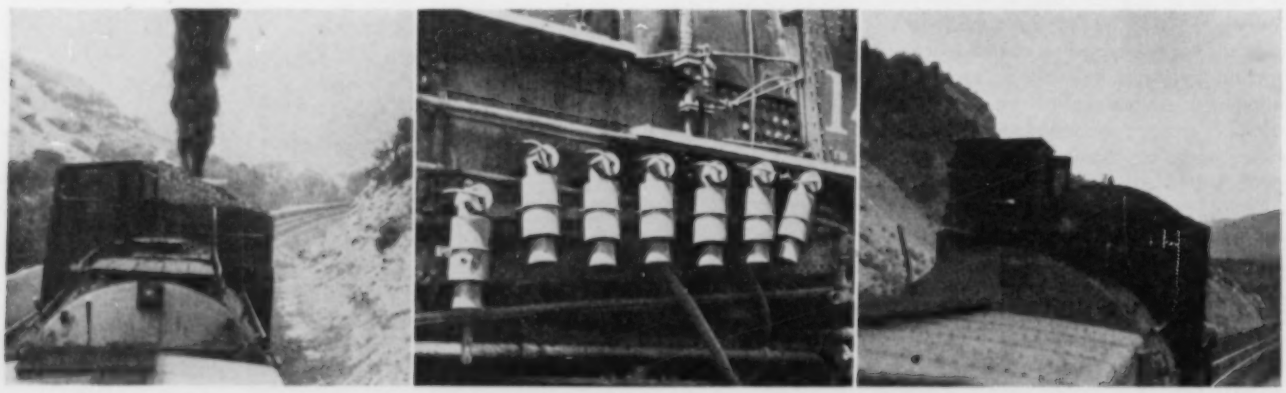
BLOWER-POWERED JETS

Diagram of overfire air jets applied to a 150-hp. hand-fired boiler in an industrial plant. By turning on the four jets in each of the two opposing side walls before each firing period and operating them for three or four minutes smoke is kept well below the maximum imposed by city ordinances.

kw. as the amount of power needed hourly to operate the jets. At three cents per kilowatt-hour, this made the operating cost of the smoke-abatement installation come to approximately two cents an hour.

On the basis of operating costs, blower-type air jets are frequently the most economical. However, steam-air jets may be used to advantage where excess steam is available. Plain steam jets are utilized where turbulence only is needed and where additional air would impair furnace performance.

Continued growth of the population in urban districts has brought the problem of reducing industrial smoke into the forefront, and modern overfire air jets are receiving recognition as a valuable tool in this work of smoke abatement. Thirty-two railroads in the United States have equipped more than 2000 locomotives with overfire jets, and a number of coal and transportation companies have supplied their river and lake steamboats with them to control the smoke nuisance. Stationary plants also are using them extensively to promote better public relations. In the City of Chicago alone there are more than 1500 blower or steam-air installations in stationary plants, and municipal ordinances now require that every newly set up stoker- or hand-fired boiler be provided with some form of overfire jet.



JETS REDUCE LOCOMOTIVE SMOKE 90 PERCENT

On a test run between Helper and Salt Lake City, Utah, one of the steepest railroad grades in the country, steam-air jets on a Denver & Rio Grande Western locomotive were found to eliminate 90 percent of the smoke normally produced. The coal burned contained 41 percent volatile matter. Pictures on the left and right show the difference with the jets off and on. The silencer-equipped jets are illustrated in the center.

Automatic Spray Booth for Painting Steel Barrels

STEEL barrels produced by the Boyle Manufacturing Division of the United States Steel Products Company were formerly spray-painted in a booth that hampered the operations and was hard to keep clean. Recently, it was replaced by a mechanized model incorporating many unusual features and designed especially to eliminate the shortcomings of its predecessor. The company reports that the new equipment does the work with far greater ease and needs considerably less maintenance.

The old booth occupied a straight section of the conveyor line which carries the barrels from the predrier through the painting cabinet and into the drying oven. The containers entered the booth lying on their sides—with their longitudinal axes at right angles to that of the booth—making it necessary for the operator to handle each one twice to paint the ends. The barrels then passed through the oven in the same position in which they entered the cabinet and had to be upended upon leaving the drier.

Off-spray from the guns fogged the lights inside the booth and fouled the guns themselves, while drippings accumulated on a dry floor, making it difficult to keep the area clean. The ends and one entire side of the cabinet was open so that it was not possible to control the air flow or excess spray. To reach the guns, the operator had to climb onto a structure wet with paint, and the driving machinery, which was located under a paint-spattered housing, was hard to get at. Also, it was difficult to change the various pieces of equipment to accommodate barrels of different sizes.

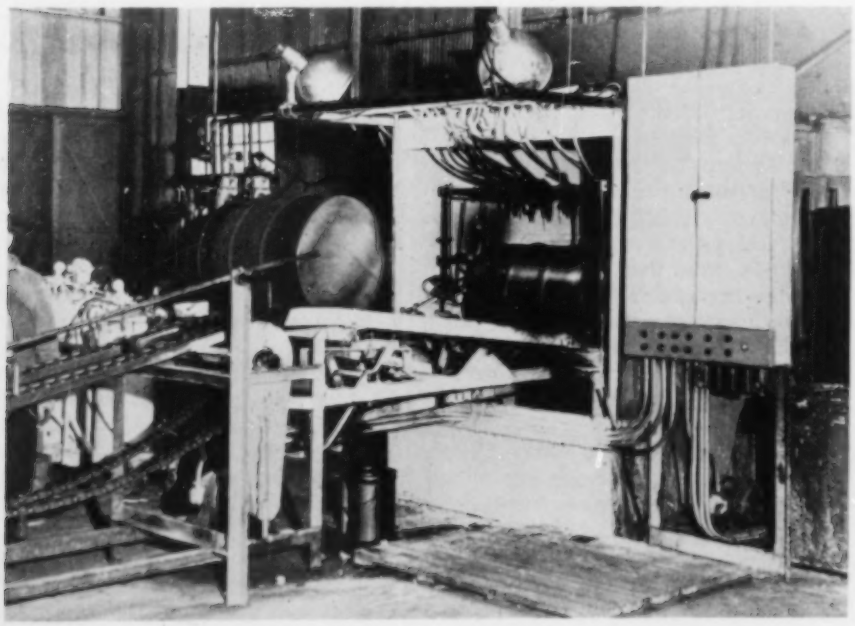
The new booth was placed at a right-angle turn in the conveyor line, permitting the barrels to enter with their longitudinal axes parallel to that of the cabinet and with their ends in line with the flow of air. A water tank catches drippings and excess spray, while vapor-proof lamps mounted on the outside flood the interior with light. All controls and machinery are located outside where they cannot be splashed with paint, and from his station the operator can easily reach into the booth to clean and adjust the guns.

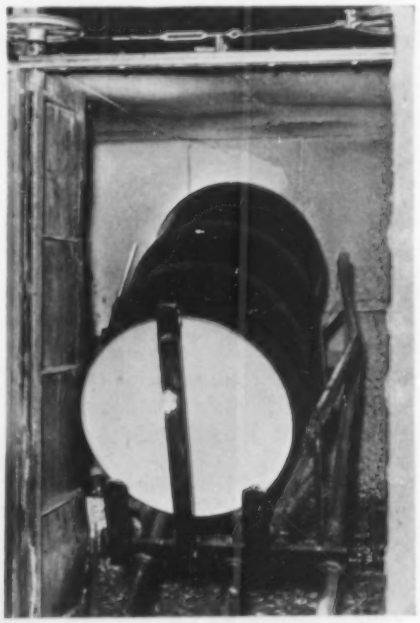
Barrels emerging from the predrier are lifted to the level of the booth by a motor-driven conveyor which delivers them to a feeder unit, a device consisting of an angle frame equipped with limit switches, solenoid valves, and a double-acting, double-cushioned air cylinder. The containers roll down 3x3-inch angle irons until stopped by an escapement rocker. When two are in position, limit switches shut off the conveyor. The pneumatic cylinder then operates the escapement bar, as well as the ejection kick bar of a barrel spinner in the booth, thus forcing the freshly painted barrel out and permitting an unpainted one to enter. Fast-rolling barrels are halted by a back stop which is mounted on the kick-bar shaft and drops as the kick bar rises.

The spinner, which holds and turns the barrels while they are painted, consists of two shafts mounted on sealed, self-aligning ball bearings and extending through the wall of the booth to an outside drive. Both the spinner shafts and the rolls are symmetrical and can be cleaned merely by holding a scraper against them while they are rotating.

Upending is done by a unit that differs from conventional types in that it transports each barrel a considerable distance and also sets it on end. It is of heavy construction, has an 800-pound counterweight, is pivoted on ball bearings, is an integral part of the outgoing conveyor frame, and passes in and out of the booth through swinging steel doors that open and close automatically. While a barrel is being painted, the upender is outside behind the closed doors, permitting a better flow of air around the work in the cabinet. When inside the booth in the down position it is directly behind the spinner and, upon reaching the up position, gently deposits the freshly painted barrel on the conveyor leading to the drying oven.

All operations during the set-up period are regulated by push buttons that are electrically interlocked to insure proper sequence and to prevent false moves such as kicking a barrel from the spinner into the water tank, etc. Push buttons also actuate timers that control the spray period of the guns, the interval each is in operation being set individually. All components of the booth, including the conveyors, can be easily adjusted to accommodate barrels of different sizes.





FEATURES OF NEW BOOTH

In the view at the left one steel drum is shown in position for painting the body and both ends simultaneously while another one is poised at the top of the incline, ready to roll into the booth. Above is pictured a newly painted drum on the upender. This carriage is stationed outside of the booth behind closed swinging doors while painting is in progress. As the spray guns are shut off it moves in, receives the drum, and transports it a few feet, meanwhile upending it and depositing it gently on a conveyor leading to the drying room.

How Michigan Battles Snow and Ice

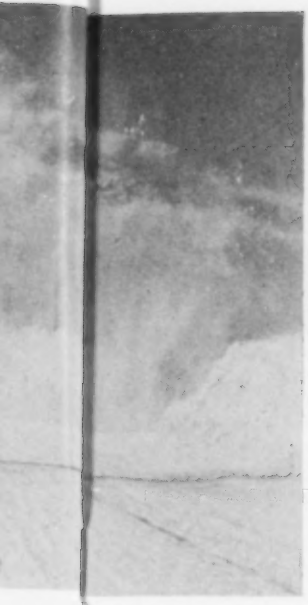
WE ARE entering the season of the year when our northern states are plagued by snow and ice. Winter brings hazardous driving conditions for motorists and, in times of storm, around-the-clock duty for the crews of workmen who tackle the task of keeping traffic moving in the face of nature's sternest impeding efforts. Each year the highway forces become better fortified with mechanical equipment to help them in their battle. Accompanying pictures show varying types of mobile units employed by the Michigan State Highway Department.

Last year Michigan spent approximately $3,000,000 to keep its 9400 miles of trunk lines open for travel. This was an average of $319 a mile, which is ample evidence of the severity of the winter. In normal times, about 75 percent of the expenditures in the southern part of the state is for ice control and the remainder for snow removal. In the central section the division is about equal, and in the northern part 65 percent goes for snow removal, 25 percent for ice control, and 10 percent for snow fences. Last year, however, conditions were such that 51 percent of the state's total was spent for ice control.

By replacing worn-out equipment that was discarded last spring and by adding other new units, Michigan has amassed a fleet of 312 motorized machines to throw into the 1948 fight against Old Man Winter. It includes 192 snowplows —180 of the blade and twelve of the rotary type—and 120 ice sanders. Two of the rotary plows are designed for service in the areas that ordinarily experience the heaviest snowfall. Built on a tractor-grader chassis, each has a large rotor fan at the outer end of the side wing. Capable of throwing snow 100 feet, their chief purpose is to slice off high roadside banks so that the wind can blow the travel surface clear of light snow that might otherwise accumulate in drifts. Blade-type plows are of little use under such conditions because high banks cannot be pushed back. By throwing the snow far back from the road, the banks are prevented from building up higher. One of these machines will be stationed at Mio and will be available for use in thirteen counties in the northeastern tip of lower Michigan. In emergencies, it can be shifted to southern counties. The other one will be based at Manistee and will serve the northwestern section of the lower peninsula.

Michigan's snow-removal crews go into action as soon as a storm begins and keep operating until trunk lines are clear. In some periods last year, especially in the northeastern part of lower Michigan where winter hit the hardest, the men stayed on duty as much as 36 hours at a stretch in temperatures that ranged around zero.

Trucks with underbody blades start clearing traveled highways before the snow is packed down by traffic. When it

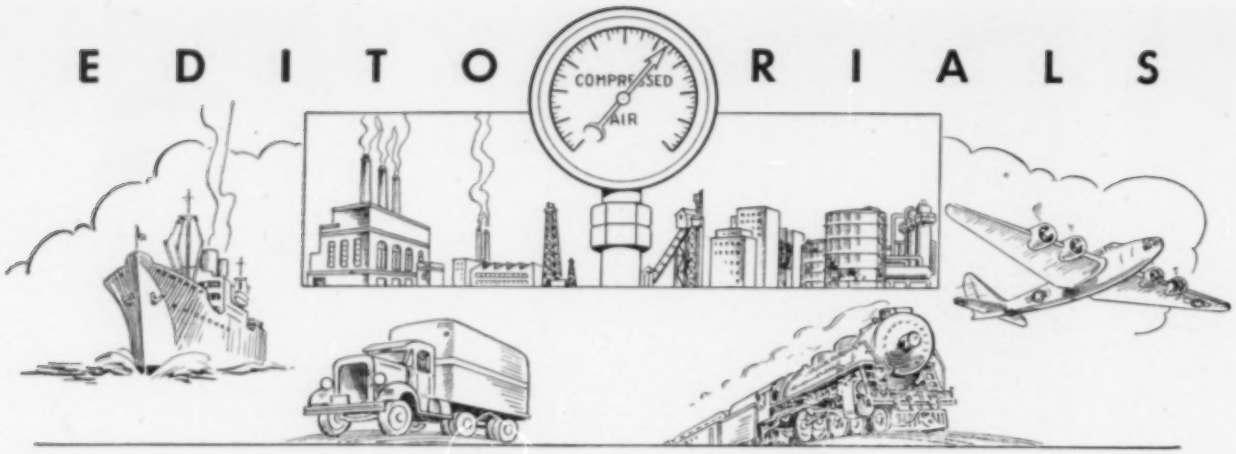


gets too deep to be handled by these units, light trucks with side-delivery plows take over. These stay out until the snow stops falling or until enough of it has piled up to require heavy trucks with side-delivery plows. After the regular equipment has gone through, the wing plows move in to slice off the high banks.

Besides snow removal, the crews have an equally difficult task in combating ice conditions. Hills, curves, and intersections must be sanded and other steps taken after each storm to clear away ice or packed-down snow. The sand trucks are sent to such slippery places to make them safe. If a layer of snow glazes over and causes an icy condition, chemically treated abrasive is applied. As soon as the chemical has loosened the ice, the latter is peeled off by trucks equipped with scrapers.

"An efficient snow-removal program," states Highway Commissioner Charles M. Ziegler, "is not only extremely important to the everyday life of our people but is also insurance against accidents. Although the cost of snow removal in Michigan may seem high, it must be remembered that the economic welfare and development of our state is dependent on a well-maintained and adequate highway system over which raw and finished materials may be moved to and from our factories and food products from our farms to markets. It must be recognized, too, that any condition which delays the normal flow of traffic also means a loss of gasoline-tax revenue, which is the highway department's sole source of income. Therefore, clear highways in winter mean more revenue and help to pay for the snow-removal work done on them."

EDITORIALS



TOOLS FOR INDUSTRY

THERE is an old adage that you must spend money to make money. Because American industrial management learned the truth of that saying long ago we have become the world's most prosperous nation. Because our factories were, so to speak, in high gear we were able to turn out war matériel that unquestionably shortened the international conflict. Our enviable position in world economy is directly attributable to the fact that management has given American workmen the best available tools and equipment.

But, even though we are at the top of the heap, there is no room for complacency. As the McGraw-Hill Publishing Company points out in a series of editorials appearing in its own trade journals and in leading newspapers, our industrial picture looks good by comparison with that of other nations because right now they are so illy equipped for manufacturing. Actually, these editorials contend, our industries have failed to provide workers with enough new tools and equipment. During the depression years they could spend little for these purposes because the money wasn't available. If expenditures from 1930 to 1948 for new plant and equipment had continued at the same rate as in the prosperous '1920's, we would have spent an estimated 100 billions more than we did.

Since the war ended, about 50 billion dollars has been laid out for new plant facilities. Even so, additional billions must be invested to bring some lines of industry up to date and to offset normal wear and tear. A third of all the freight cars are more than 25 years old, two-thirds of our textile looms have been used more than twenty years, and half of the steel mills' coke ovens have been operating for the same period. Expenditures by the power generation and petroleum industries during the next decade to enable them to keep abreast of demands are set at 7½ billions in each case.

Labor is, or should be, as much interested as management in getting these additional, better facilities. To quote from one of the aforementioned editorials, "Whether Americans live well or badly depends directly on the kind and quality of tools used by American workmen." Given the most effective tools and machines available, each workman can increase his productiveness. And when he does this, management can afford to put more in his pay envelope without raising the selling price of the article he is helping to make. The building of these tools and machines is important in itself, for it brings steady employment to about 30 percent of all our industrial workers.

The foregoing discussion relates closely to an article in this issue that points out the time- and labor-saving potentialities of air power. It cites case histories that reveal rather startling instances of cost cutting by intelligently applying air-operated tools and equipment. In view of these findings, it behooves the management of every industrial plant to study its operations to find out if it can profitably put air power to work. Actually, as the article explains, the necessary research will be done for it upon request by the world's largest manufacturer of compressors and pneumatic tools.

STANDARD SCREW THREADS

A SIGNIFICANT step towards international standardization was taken last month when the United States, Great Britain, and Canada signed an agreement to use interchangeable screw threads. The event climaxed efforts that have been underway for nearly 30 years. So much trouble was encountered during World War I with divergent threads that an American delegation went to London in 1919 bent on eliminating existing differences, but it got nowhere. In 1926 a British delegation came over here with the same intention, but again without results.

When World War II began, the problem of thread variations became acute. Both nations were producing many, similar types of equipment, but parts weren't interchangeable because of thread differences. One authority has estimated that 600 million dollars and six months of time could have been saved by the Allies in the first year of the conflict if unified standards had been in force No one has attempted to make a similar estimate covering the total war production. As a temporary measure, the United States adopted a standard conforming in part to British design for equipment also made in Britain.

Wartime experience again revived efforts at standardization, and the agreement reached last month was the outgrowth of meetings held since 1943 in the three countries concerned. The British system was originated by Whitworth in 1845 and is based on a thread angle of 55° and a thread form having rounded crests and roots. The American system, introduced by Sellers in 1864, has a thread angle of 60° and a thread form with flat crests and roots. Canada, owing to its ties with Britain and its proximity to the United States, had to make threads conforming to both.

In the unification now agreed upon, Britain made the major concession by consenting to change from a 55- to a 60-degree thread angle. The United States agreed to adopt a rounded root for bolt threads. It also consented to change the pitch of a half-inch coarse thread from thirteen threads an inch to twelve. This deviation from British practice had been especially bothersome in the past.

It has been said that no machine exists that has not, somewhere, screw threads for the interconnection of parts. The importance of thread uniformity is therefore obvious. This country alone uses in excess of two million tons of metal annually in making fasteners, most of them threaded. There are more than 250,000 kinds and sizes, and they are made in hundreds of plants. One, Russell, Burdsall & Ward Bolt & Nut Company, turns out fifteen million daily.

Having at last reached an accord in this important technical matter, the United States and other leading nations may be expected to tackle other pressing problems in connection with standards variations.

This and That

Hundred Millionth Automobile

The Automobile Manufacturers Association recently announced the fact that this country has produced 100 million automotive vehicles. Of them some 40 million, including about seven million trucks and buses, are still running. The Duryea brothers are credited with having built the first American car powered by a gasoline engine in Springfield, Mass., in 1893. It took 25 years to turn out the first million machines. Current production is at the rate of 30 passenger cars and ten trucks and buses per minute every working day.

A million persons are employed in parts factories and assembly plants. Eight million more make a living selling, servicing, or driving vehicles. All told, about one out of every seven wage earners is supported by the automotive industry. The average price of a new automobile was $1791 in 1909, $800 in 1939, and $1460 in July, 1948. However, a typical American workman could buy this year's car with 27½ weeks of wages, whereas he had to labor 33½ weeks to pay for one in 1939.

The first cars were built in Europe, yet the United States assumed the lead by learning how to turn them out in volume and, consequently, at lower cost. As a result, only 24 million vehicles were produced in the rest of the world while we were building 100 million. More than 1500 companies have manufactured automobiles at one time or another in the United States. Today, 56 firms produce 21 makes of passenger cars, 39 makes of trucks, and 20 makes of buses. The 77 assembly plants, located in 24 states, are fed by 1000 parts makers and 20,000 other supply concerns. Materials entering into these vehicles come from all 48 states and about 60 foreign countries.

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New or Old?

From time to time we are reminded that many ostensibly modern mechanical ideas are actually not new. Proof that this is true in the automobile field is contained in a talk made to a Los Angeles engineering group on October 27 by Harold T. Youngren, vice-president and director of engineering of the Ford Motor Company. He pointed out that the 1888 Benz car had its gearshift control mounted on the steering column. At least five other manufacturers adopted the innovation temporarily, but switched to the center "wobble-stick" when the steering wheel was changed from the right- to the left-hand side.

Horizontal engines with opposed cylinders are being talked about a lot now and are considered brand new. Actually, the Schact auto had such an engine in 1909 and, moreover, was mounted in the rear of the vehicle. The 1910 Brush car featured coil springs on all wheels. In 1923, the Pierce-Arrow Company and the Aluminum Company of America jointly produced an automobile that was 85 percent aluminum by weight. Ten models were built and some of them ran 100,000 miles without developing serious trouble. For that matter, the Stevens-Duryea car of 1902 had an aluminum body, including a solid-metal top. One of steel was generally adopted only a decade or so ago. These ideas didn't stick at the time they were introduced, according to Mr. Youngren, because they were too early, too expensive to be commercial, or not sufficiently developed to meet current needs.

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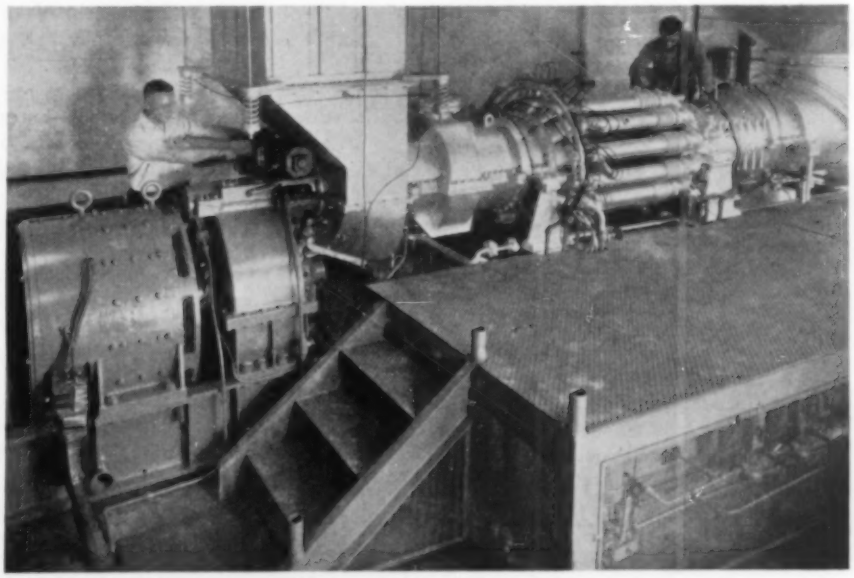
Balanced Railroad Wheels

Motorists have known for some years that balanced wheels make for a smooth ride. Now the railroads are finding it out and starting to do something about it. Next month, the Association of American Railroads will report on recently conducted tests and recommend wheel balancing. Railroad wheels, although perfectly round, are invariably out of balance because the density of the steel varies and causes an uneven distribution of weight. The imbalance usually ranges from 4 ounces to 3 pounds. At 200 rpm. (equivalent to a train speed of 21 miles an hour) a wheel that is one pound out of balance creates a centrifugal force of nearly 25 pounds. At 570 rpm. (60 miles per hour) the imbalance generates a centrifugal force of 161 pounds. The effect, with each of the eight wheels on a car fighting the unbalanced motions of the others, is to set up vibrations which manifest themselves in bumping, swaying, whiplashing, etc. Tests show that when all wheels are in balance a car rides smoothly at speeds up to 100 miles per hour. Brimful glasses of water in dining cars don't spill.

Wheels are put in balance by first spinning them on a machine that indicates the amount and exact location of excess weight. This condition is corrected by adding an equal weight at the point directly opposite the excess. The only train with balanced wheels now in regular service is the Illinois Central's "Daylight Special" that covers the 300 miles between Chicago and St. Louis in 310 minutes. Other lines intend to adopt balancing as a part of a campaign to regain lost passengers.



FIRST GAS TURBINE FOR INDUSTRIAL SERVICE

Through the co-operative effort of three companies, the 2000-hp. gas turbine pictured above will be put to work early next year driving a compressor on a natural-gas line between Monroe, La., and St. Louis, Mo. This is believed to be the first industrial application of a mechanical-drive gas turbine in this country. The machine was built by Westinghouse Electric Corporation at Essington, Pa., and has had test runs there for more than 1000 hours. It is soon to be shipped to the Mississippi River Fuel Corporation which will use it to operate an Ingersoll-Rand centrifugal compressor at 8750 rpm. for transmitting natural gas. The arrangement provides for a 6-month trial period. The turbine and compressor will be mounted on a common bedplate. Indicated advantages of the gas turbine for service of this kind are: It will produce more energy per pound of weight than any other form of power plant and can be trucked into remote locations, set up on a simple concrete-mat foundation, and made ready for operation in a few hours. It requires no water and little lubricating oil. Its few moving parts promise to minimize maintenance.

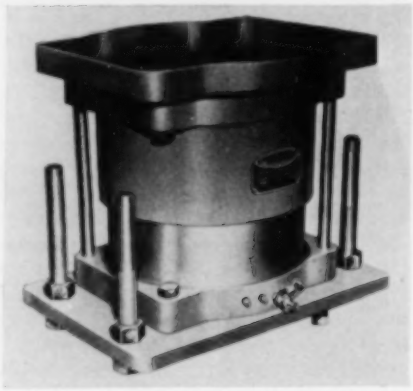
Industrial Notes

After a long period of development and field testing, The Foxboro Company exhibited a unique recording instrument at a recent show in Philadelphia, Pa. It is based on a completely electronic principle and, with but one measuring system, makes from one to six different records on a circular chart by the use of a Rotacolor Pen Wheel. The latter has six pens which are magnetically selected in turn and held in marking position by a single arm. Each record is a series of colored dots spaced so closely that it appears to be a continuous line. A positive-acting switching unit automatically brings the varicolored pens into place at 6-second intervals and in any sequence desired for measuring temperature,

pressure, humidity, liquid level, pH, conductivity, speed, or other process variable. A special "dry ink" insures clean records, and the instrument is said to operate continuously for several weeks without the need of re-inking. It is known as the Multi-Record Dynalog Electronic Recorder.

Windows, windshields, lenses, incandescent bulbs, lamp shades, mirrors, and other glass or plastic surfaces that reflect light can be made glareproof, it is claimed, by giving them a film of Polacoat, a polarizing fluid recently put on the market by Polacoat, Inc.

Dayton Rogers has announced an improved die cushion—Model CBM—that is adapted for use with a cylinder mounted on a plate carried by four suspension rods. This arrangement permits removal of the bolster plate without removing the die-cushion cylinder. The pressure pad is machine cut to fit the press-bed opening so as to utilize the entire area, and two stop rods prevent the cylinder from becoming detached from the piston should the air be turned on when the bolster plate is removed.



The cylinder may be drained by means of a petcock and greased by fittings on the lower part of the unit. Each cushion is provided with a combination regulator and gauge and may be equipped with a surge tank to obtain maximum drawing capacity. Units are available that exert ring-holding pressures from 1½ to 75 tons with air at 100 psi. line pressure.

Aluminum tape 0.01 inch thick and coated on both sides with a bituminous compound is being used to insulate the walls of Moscow's subways against ground-water leakage. The material is called Metalloizol by the Russian inventors and is applied at a temperature of 300-350°F. Some 10,000,000 square feet of the insulation has been utilized to protect a 3-mile section of concrete tunnel.

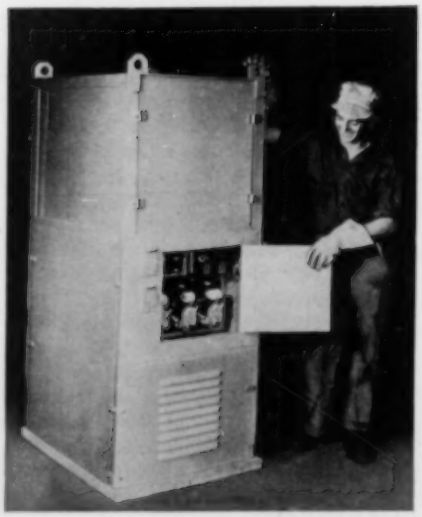
Transformers built by Allis-Chalmers are being filled with Chlorextol, a non-sludging, noninflammable insulating liquid of high dielectric strength developed by the company and approved for that service by Underwriters' Laboratories. Units so charged are said to have the same electrical characteristics, rating for rating, as the oil-insulated type and save the cost of fireproof vaults. They can be installed right at the load centers.

Perlite, a volcanic glass, is being converted into an aggregate for use as a plaster base and in making bricks, concrete blocks, and slabs. The raw material is ground and heated first at a temperature of 900° and then at 2000°F. to vaporize the contained water. Under the pressure of the steam the perlite expands from six to ten times its original size, and in the processed form weighs from 3 to 12 pounds per cubic foot. The aggregate also has good thermal insulating properties and is fire resistant.

Many castings previously rejected because of porosity are salvaged by impregnation with a sealant under vacuum and pressure. One of the newest of these is a thermosetting copolymer intended for low-density metals such as aluminum and magnesium alloys but applicable also to bronze, steel, and gray iron. The viscosity of the resin can be controlled to meet a wide range of needs and to insure proper flow. Further claims made for it are that it will not bleed out in curing, has a heat resistance in excess of requirements, and that water, salts, moderate acids and alkalies, petroleum products, etc., have little if any effect on it. Sealant P.E. No. 1 is made by Western Sealant Company.

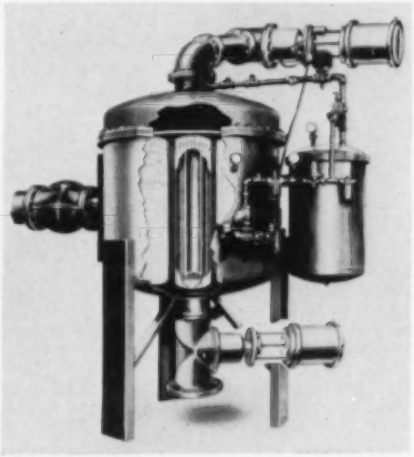
Conventional sink-and-float equipment for separating ores weighs hundreds of tons and has to be installed permanently. Contrast this with a unit that weighs one ton and is small enough for truck haulage. The portable separator is based on a process patented by the American Zinc, Lead & Smelting Company and licensed through the American Cyanamid Company. It is mounted in a frame 8 feet long and 3 feet wide and operated by one man. The ore is spread across the top of a cone filled with a mixture of water and ferrosilicon. The specific gravity of the latter is controlled so that the light material or waste floats and the ore sinks. The equipment has a capacity of 1500 pounds an hour and is intended for cleaning up small deposits.

For the comfort and health of crane operators in factories or foundries where they are exposed to heat, dust, fumes, and noxious gases, the Dravo Corporation has developed a cab air-conditioning unit that is about half the size of an earlier model built for use around soaking pits in steel mills and other areas where temperatures are extremely high. The new unit is about 5½ feet high and can be mounted alongside the cab or on an adjoining catwalk. Air is used for condensing purposes in the cooling coils, and Freon 114 is the refrigerant. Electric



strip heaters keep the cab warm in winter. Ventilating air is circulated at the rate of 400 cfm., and filters and activated-carbon cannisters remove dirt, dust, fumes, and gases from the air stream to which make-up air is added at the rate of 100 cfm. The equipment is designed for operation in ambient temperatures up to 130°F. and maintains cab temperatures at 80-85° in summer and 68-72 in winter.

To supply machine tools with a continuous flow of clean coolant, the Honan-Crane Corporation has introduced an automatic clarifier that features a blow-down mechanism. The coolant with solids in suspension is admitted by a side valve into a housing containing cylindrical wire-mesh screens through which it is forced under pressure, the cleaned liquid entering a chamber at the top from which it passes to the tools. At predetermined intervals, dependent



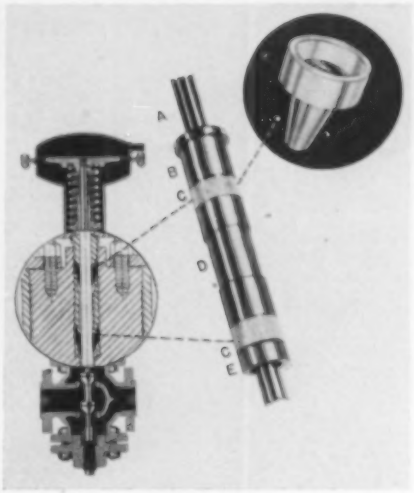
upon the contaminant and the amount present in the coolant, a timer actuates a solenoid valve to feed compressed air to three pneumatic cylinders to close the inlet and outlet valves and to open the drain valve for blow down. Simultaneously, air pressure built up in a surge chamber alongside the housing is exerted against the free surface of the clean coolant in the top chamber, forcing it back through the filtering elements to strip them of the accumulated deposit and to wash it into a tank below. At the end of the blow-down period, which lasts approximately 5 seconds, the timer reverses the flow. The coolant used to remove the cake from the screens is filtered for recirculation. The clarifier is available in seven sizes ranging from a single-tube model with a flow rate of 1 to 15 gpm. to one with 37 tubes and a capacity of 1000 to 1200 gpm.

Most aluminum alloys that were heretofore limited to anodizing can now be processed in a few minutes by immersion in a chemical bath, according to an announcement by the Colonial Alloys Company. Ordinary steel tanks are used, and the treating solution is heated and maintained at a temperature of 200°F. The operating cycle involves cleaning and rinsing, treating and rinsing, and sealing and rinsing. Licenses for Chemoxiding are obtainable from the company, which is prepared to treat samples free of cost.

At a recent meeting of the American Chemical Society it was announced that chemists have succeeded in producing a "completely synthetic varnish" from glycerol allyl ether, a new petroleum chemical. Credit for the achievement goes to three members of the research staff of the Shell Development Company, which claims that the new coating is insoluble, hard to damage with chemicals, and scratch resistant. It is applicable for use in place of resins made from artificial materials and scarce natural drying oils.

One of the exhibits that attracted considerable attention at the recent Foundrymen's Association Congress in Philadelphia, Pa., was the Ther-Monic Electronic Core-Baking Tunnel developed by the Induction Heating Corporation. Its use eliminates racking and much of the handling of green cores ordinarily done. They may be loaded onto the tunnel conveyor in the core room, and after emerging from the tunnel the baked cores may be transferred directly to inspection tables. If they meet requirements they can be put to immediate use because there is no need to take time out for cooling. With an average baking cycle of not more than a few minutes, the new equipment has a capacity of 650 pounds of cores an hour and can produce a ton at a power cost of 92 cents. It is further claimed that losses are cut to less than 10 percent, as compared to 30-40 percent with conventional core binders and baking.

Packing boxes on fluid control valves are eliminated, it is claimed, by an inert plastic seal that has recently been introduced by the Hammel-Dahl Company. According to the manufacturer, it provides a frictionless, leakproof valve stem



regardless of the static pressure on the valve body. The accompanying illustration shows how the Dahl-Seal, as it is known, is installed in a diaphragm control valve. Though gland follower "B," gland "D," and lower gland "E" clamp the seals "C" firmly in place, the lower lip is unsupported and subjected only to the system pressure. It is this pressure on the lip that hermetically seals the superfinished valve stem "A." The latter can be positioned to an accuracy of 0.001 inch at pressures up to 25,000 psi. Seal is self-lubricating and resistant to chemical attack and can be used at any temperature for which valve is designed.

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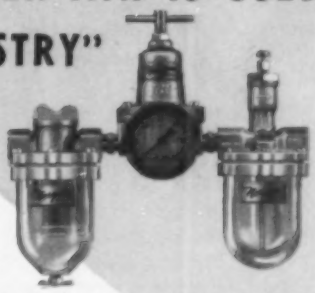

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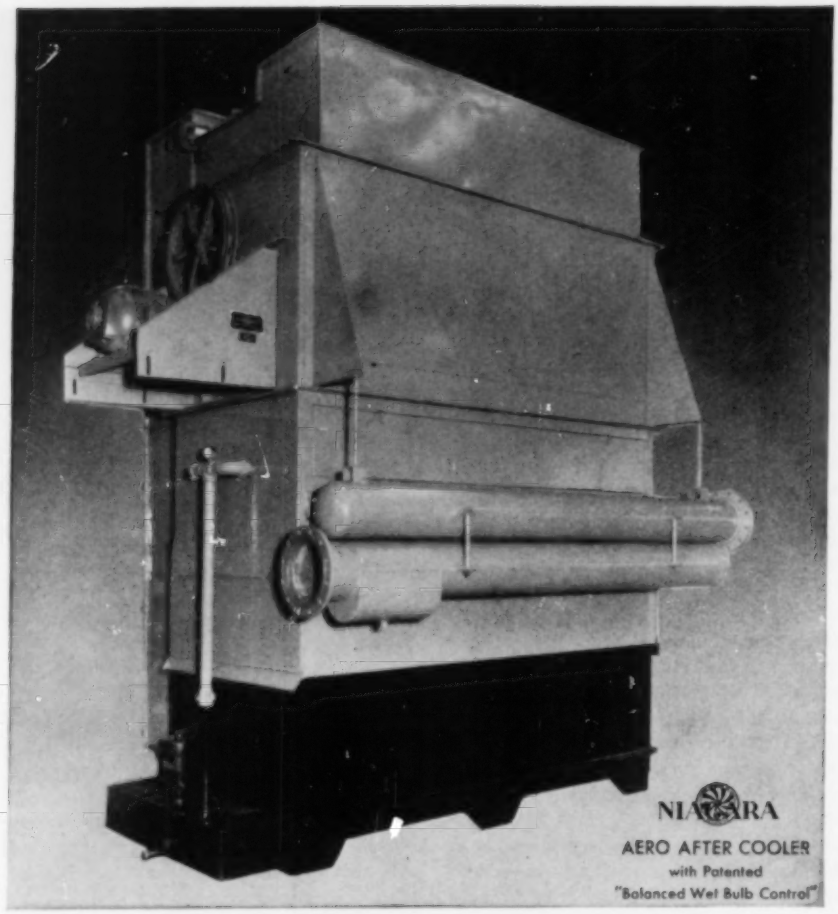

How to PREVENT CONDENSATION in COMPRESSED AIR LINES

● Users of pneumatic tools and machinery spend thousands of dollars on repairs and suffer much interruption to production from the condensation of water in their air lines. In compressed gas systems and in processes where compressed air is blown directly on parts and materials in production, there is additional damage.

You can prevent these losses by installing a Niagara Aero After Cooler. It cools the compressed air or gas by evaporative cooling and removes the water before the air enters the receiver. This method brings the air to within a few degrees of the wet bulb temperature, making certain that your compressed air will always be colder than the atmosphere surrounding the lines in your plant, so that no further condensation can take place.

Savings in cooling water pay for the installation. Experience shows that the patented Niagara evaporative cooling method consumes less than 5% of the water required for cooling by conventional means. You save the cost of the water, the cost of pumping it, the cost of disposing of it. These extra savings soon pay for the Niagara Aero After Cooler.

Write for Bulletin No. 98 CA

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Industrial Literature

A technical bulletin on the subject of cold-finished Jalcase steel has been prepared by Jones & Laughlin Steel Corporation, Pittsburgh 30, Pa. Jalcase Steel is a free-machining, open-hearth steel intended for the production of machined parts that should possess good mechanical properties and respond well to heat treatment. The bulletin contains complete information on the physical properties of the steel and gives numerous examples of its use.

Combination oil and gas burners for industrial plants are described in Catalogue No. 408 obtainable from the Hauck Manufacturing Company, 124-136 Tenth Street, Brooklyn 15, N. Y. Possessing one connection each for air, oil, and gas, the burner may be switched from one fuel to the other at will. One operating lever controls the admixture of air with either oil or gas, and by means of measuring orifices automatically and accurately proportions the fuel-air mixture throughout the entire firing range.

Obtainable from the International Nickel Company, 67 Wall Street, New York 5, N. Y., is an illustrated booklet that deals with corrosion problems such as are encountered in the salt industry and by large-scale users of brine solutions. It lists some of the steps taken to control them, gives some of the early history of the salt industry, and describes the methods by which the mineral is produced and refined. The publication also contains information about the equipment used.

Nozzles for atomizing liquids are described in Catalogue No. 23 obtainable from the Spraying Systems Company, 4021-27 West Lake Street, Chicago 24, Ill. They are of the type used in industry and in chemical and scientific research work for reducing all sorts of fluids to a uniform, highly atomized spray by compressed air or other gases or by steam. Depending upon the type, liquids are delivered to the nozzles by gravity, by siphoning, or by pressure and mixed either internally or externally. The bulletin describes the many different types and sizes of nozzles available, the liquids that can be atomized, the spray patterns that can be produced, and the various applications.

Allis-Chalmers Manufacturing Company, Milwaukee 1, Wis., has prepared a catalogue —No. 11B6895—to help simplify and speed up the layout of its standardized load-center-unit transformer substations ranging in capacity from 100 to 2000 kva. The 20-page planning and engineering guidebook contains information on dimensions and arrangements of the packaged units so that headroom and floor-space requirements may be determined in advance of delivery. A number of installations are shown, and specifications for both dry and liquid-filled types of transformers and for metal-clad switchgear and other accessory equipment are given. A second bulletin, No. 11B6285A, points out the advantages of such units and tells how further economies in space and money may be effected by incorporating motor control and power rectifiers with the transformers and switchgear.

The eighth edition of *Standards of Hydraulic Institute* is now available in a completely revised form. It is divided into six parts: a general section, a data section, one each on centrifugal pumps, rotary pumps, and reciprocating pumps, and an entirely new section dealing with tentative standards on pipe friction. Those covering the three broad classifications of industrial pumps each embody their own test code. Hydraulic Institute is a trade association of the prin-

cipal United States manufacturers of displacement and centrifugal pumps. Its purpose is to be of service to engineers, buyers, and users of pumps, as well as to its members. Towards this end it has collected and incorporated in *Standards of Hydraulic Institute* pertinent technical and engineering data to serve as recommendations for what is considered good engineering practice in the pump industry. The book can be obtained from the Institute at 90 West Street, New York 6, N. Y. Price is $3 postpaid in the U. S. and its possessions.

Speed control for boiler-draft fans is the subject of a booklet recently issued by Electric Machinery Manufacturing Company, Minneapolis 13, Minn. Illustrated with graphs, diagrams, and installation pictures, the 20-page publication describes how adjustable-speed magnetic drive, together with the Regutron control, provides precise, dependable speed control over a wide range of operations. Also available is Issue No. 24 of the company's *E-M Synchronizer* containing information on motor requirements for high-inertia loads, new materials and methods of coil insulation on large alternating-current motors, and the role of motors in producing and preserving food.

A 43-page catalogue describing instruments used in the treatment of sewage and industrial wastes is obtainable from the Brown Instrument Company, Wayne & Roberts Avenues, Philadelphia 44, Pa. Schematic diagrams, photographs, and dimensional drawings help to explain the text the purpose of which is to acquaint engineers, superintendents, and operators of sewage and waste-disposal plants with the many applications of measuring and control equipment in their field of work. Instruments described include electrical and mechanical flow and liquid-level meters, pneumatic remote-transmission systems, thermometers, pressure gauges, electronic recorders and indicators. Copies of Bulletin No. 7301 will be sent upon request.

Obtainable from Cochrane Corporation, Seventeenth Street & Allegheny Avenue, Philadelphia 32, Pa., is Bulletin No. 4460, describing a multiduty, single-control valve for use on zeolite softeners and pressure filters. With four normal and two standby operating positions, it performs the work of six valves. The operating positions provide separate control of backwash, regenerant feed, rinse, and service, and maintain a different flow rate in each case with no interference from the others. One of the standby positions permits the container serviced by the valve to be isolated from the supply lines, and the second drains the container to bed level for inspection. The valve is operated by the water flowing through it.

Aluminum Alloys and Mill Products is the title of a 162-page handbook prepared by Reynolds Metals Company. It contains 163 tables and 33 pages of text, and covers a wide range of subjects such as heat-treatable and nonheat-treatable alloys, casting alloys, casting methods, and foundry practice; sizes and shapes; physical, mechanical, and chemical properties; and fabrication characteristics of aluminum alloys. Production methods discussed include blanking, drawing, stretch-forming, spinning, embossing, coining, stamping, bending, machining, forging, welding, brazing, soldering, and riveting. Included is a section on finishes for aluminum surfaces, as well as one on aluminum pig and ingot products and how they are made. The data book is available without charge to engineers, designers, and technical men and can be obtained from the company at 2500 South Third Street, Louisville 1, Ky.

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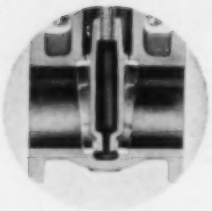
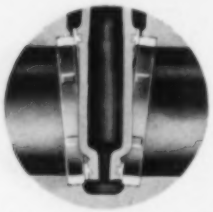


Straight-Flow Port Design reduces fluid turbulence to a practical minimum.



Seat Rings of end-seated type are screwed into the body.

Sure-Grip Malleable Handwheel for non-skid gripping even with heavy gloves.

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with screwed or flanged ends

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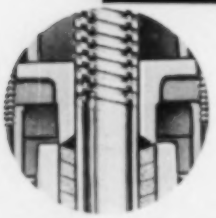
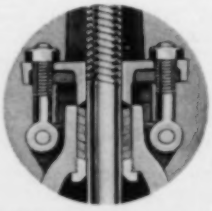


Brass Liner on Glands assures greater resistance to corrosion and scoring.

T-head Disc-to-Stem connection on OS&Y types provides stronger connection, prevents loosening of disc by corrosion.

Bronze Back-Seat Bushings in bonnets of OS&Y valves.

Solid Web Type Disc in OS&Y valves for greater strength and longer service.



Hinged Gland Eye-Bolts on OS&Y valves permit faster, easier repacking under full pressure.

For complete information on these new Walworth Iron Body Valves, see your local Walworth distributor, or write for bulletin 106.

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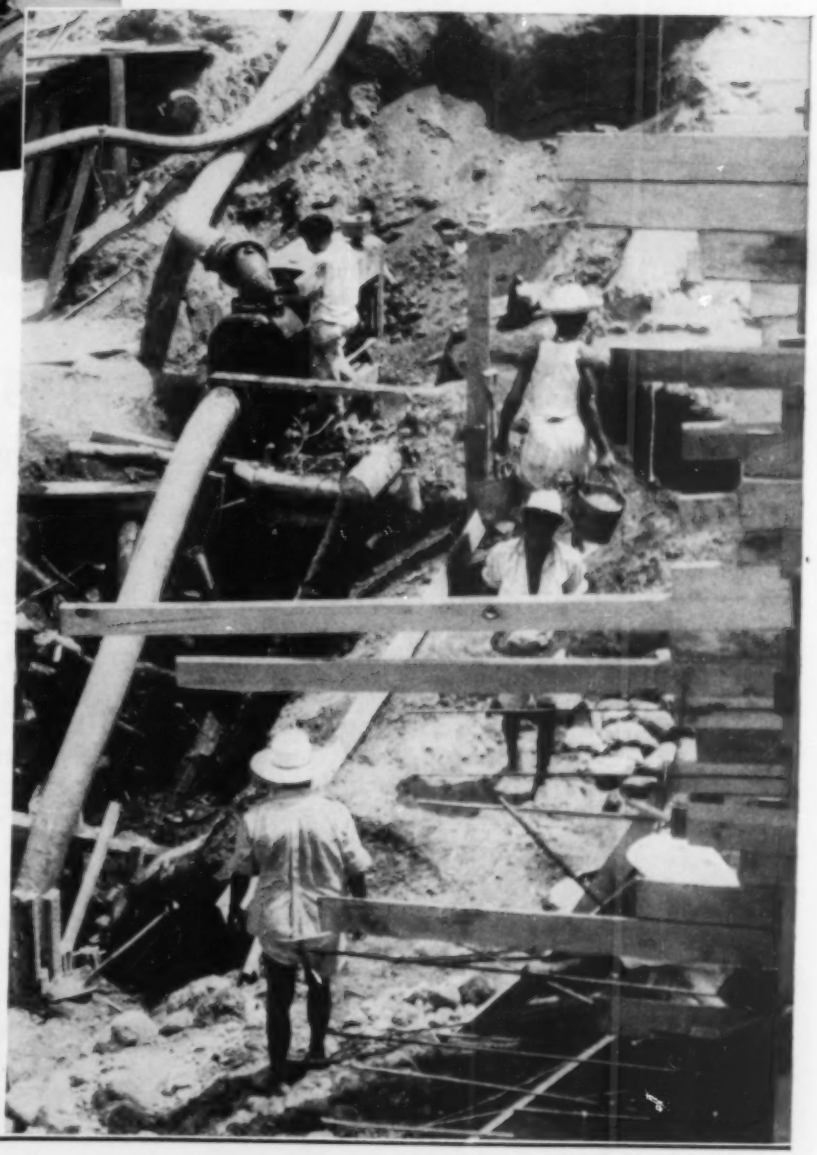

Canals for the irrigation works at Antigua, Veracruz, Mexico, are being dug by the Compania La Alhambra, S.A. These good neighbors know good power. They get it from Waukesha Power Units. The one shown here, driving a Jaeger dewatering pump, is a Waukesha Model 6-BZU.

With the combination of its *Controlled Turbulence* Combustion Chamber and specially designed intake manifold more usable power is built into this Waukesha unit, in such a way that it can put out that extra power with increased fuel economy.

Specially shaped to increase turbulence, the *Controlled Turbulence* Combustion Chamber speeds up combustion in the orderly, progressive manner which reduces "ping," and insures the complete burning of the charge before the exhaust valve opens. This means less fuel, yet more power.

And the fuel charge is evenly distributed between the cylinders. That means *smooth* power. Heating of incoming fuel-air mixture varies, as load requirements vary. This makes the engine respond instantly to power demands.

Send for Bulletin 1269

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MINING MEN from many countries have remarked upon the pleasing appearance and efficient performance of hoisting equipment in Canadian Mines.

Such comments are a tribute to the ability and good housekeeping of mine mechanical staffs and to progressive ideas in manufacturing engineering.

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The selection of a hoist which will efficiently handle today's loads and provide a margin for tomorrow's growth requires careful consideration and close co-operation. We will gladly help in planning such installations.

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Further information regarding C-I-R Mine Hoists may be obtained from Ingersoll-Rand branches throughout the world.

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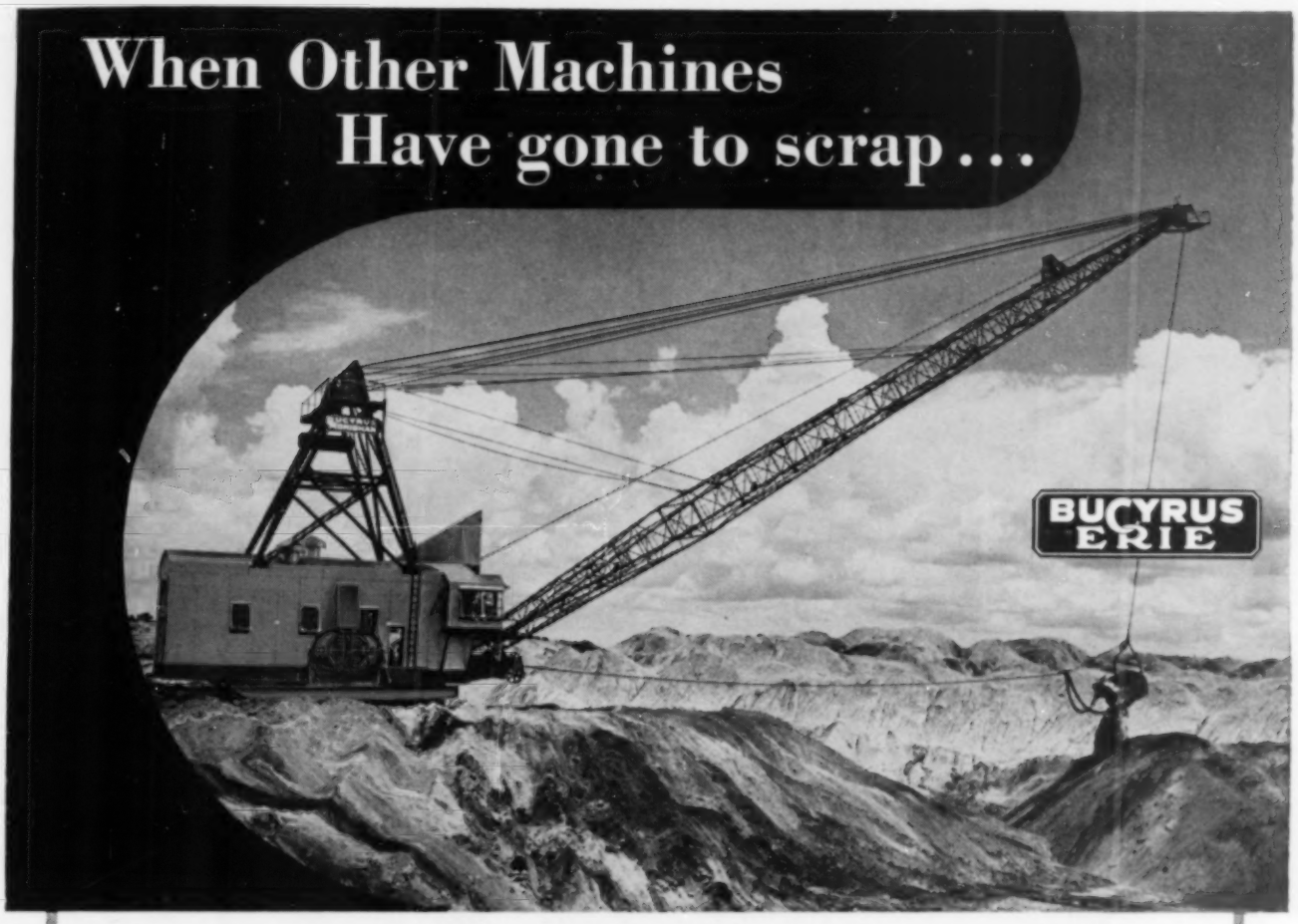
K-9



Bucyrus Walkers are Still Moving Dirt

Field performance records have proved that Bucyrus-Erie walking draglines are good for years and years of big output — that they have the strength in every part to endure in spite of a steady diet of tough digging.

Their "years ahead" digging speed and smoothness lasts because the strong machinery has the simplicity that keeps maintenance requirements low and digging efficiency high. The absence of complicated gadgets means less trouble and longer life because there is so little that can go wrong.

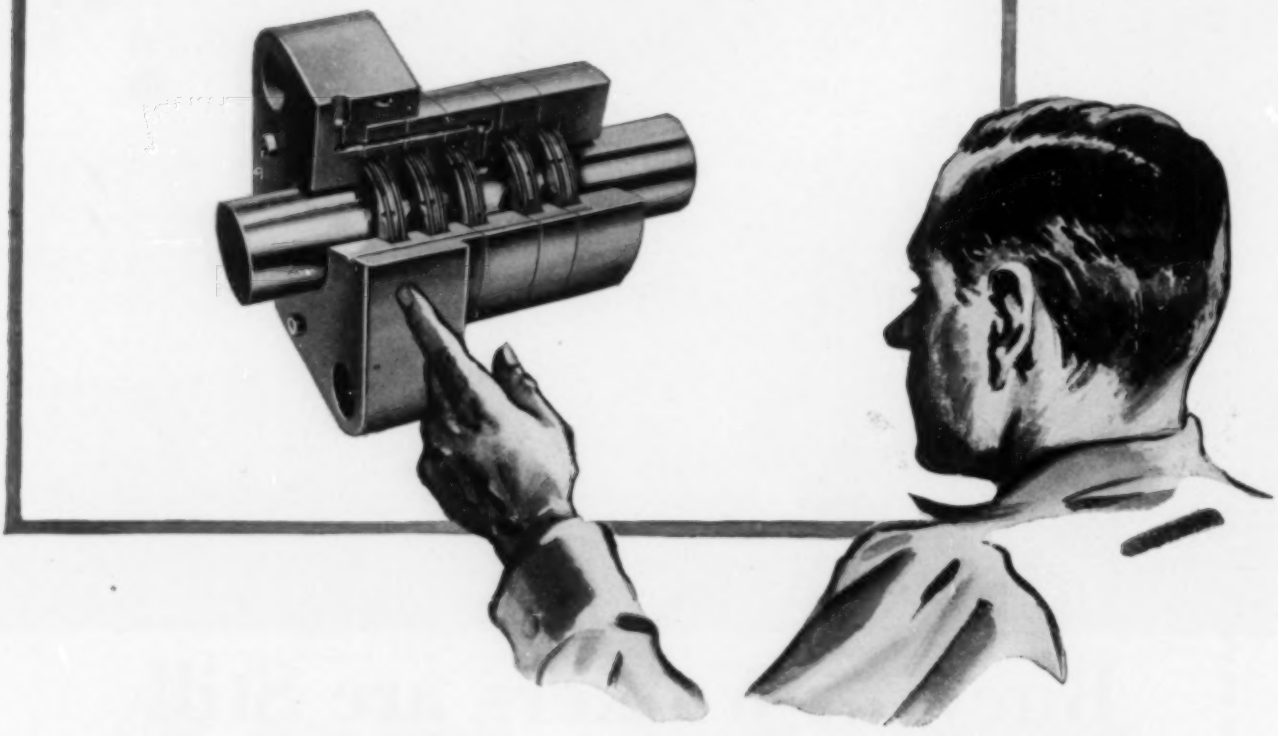
The walking mechanism lasts, too, because its smooth-working rolling cam action evenly "cushions down" the machine's weight with each step, over rough ground or soft, without the bumps or jars that cause destructive stresses. Bucyrus-Eries step out safely, positively, and gently even after many years of steady use.

BOOMS: 110 to 250 ft.
BUCKETS: 4 cu. yd. to 25 cu. yd.

21M47

Bucyrus-Erie Co.
SOUTH MILWAUKEE, WISCONSIN

How to Reduce Friction Losses—
use COOK METALLIC PACKING



IT'S really quite simple. Just replace packings made of friction-producing substances with Cook Metallic Packing, the modern rod seal.

In Cook Packings, the rings are made of proven anti-friction metals such as Babbitt, Bronze, or Cook Graphitic Iron as the conditions require. Moreover, the rings float in the grooves if rod deflection is present and ride over an oil film, thus holding friction to a minimum.

Cook Packings have been doing this for over 60 years—doing it so successfully, in fact, that today they are used exclusively as original equipment by a number of compressor and engine builders and by others for severe service conditions.

Operating engineers can get the benefit of this modern rod seal by ordering direct for existing equipment—or by specifying them when ordering new equipment.

C. LEE COOK MANUFACTURING CO.
INCORPORATED
LOUISVILLE, KY.

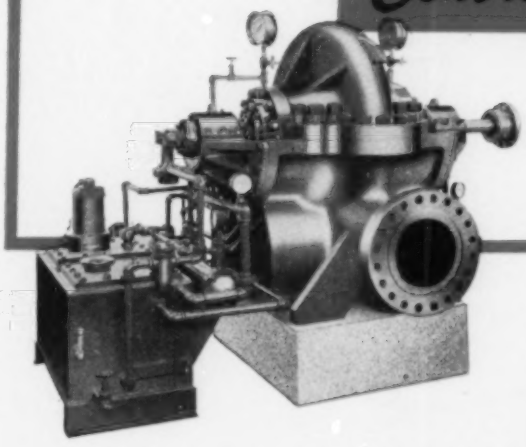
BALTIMORE • BOSTON • CHICAGO • CLEVELAND
HOUSTON • LOS ANGELES • MOBILE • NEW ORLEANS
NEW YORK • SAN FRANCISCO • TULSA

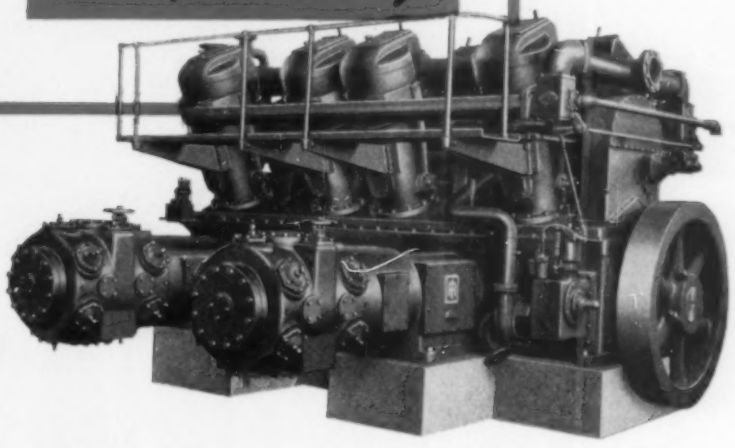
Sealing Pressures Since 1888

BETTER PACKING FOR MORE EFFICIENT RESULTS—THROUGH METALLURGY

Which COMPRESSOR should you install . . . for natural gas transmission?

Centrifugal **or** *Reciprocating*





(Ingersoll-Rand makes both)

This is a natural question—especially in view of the tremendous amount of interest that has been stirred up by the new Ingersoll-Rand centrifugal compressors. Actually the choice between centrifugal or reciprocating compressors is always a matter of economics. There are many factors that come into the picture for any proposed installation, such as:

- Location
- Installed cost
- Cost of electric power
- Cost of steam generation
- Value of gas saved with electric drive
- Availability and cost of water
- Net pipeline capacity with different types of drive
- Station spacing and compression ratio
- Overall operating cost

HERE'S A SUGGESTION: Call in an Ingersoll-Rand engineer, he will be glad to help you make a thorough study of the economics of your proposed installation. Careful consideration of all factors involved will help you determine the type of compressor equipment that is best suited to your requirements.

COMPRESSORS · TURBO BLOWERS
PUMPS · OIL & GAS ENGINES · REFRIGERATION
ROCK DRILLS · AIR TOOLS

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

350-12

"Flex-Disc" CLUTCH HYDRAULIC CONTROLS*

now on I-R MOBIL-AIR Type KA Compressors

COLD weather clutch operation in outdoor equipment has now been made easy and dependable by the *Flex-Disc* Clutch Hydraulic Control with which all of Ingersoll-Rand's new *Mobil-Air* Type KA Compressors are equipped.

Finger tip pressure on valve handle to engage, on pump handle to disengage, operates this spring-loaded (4300 lbs. pressure) clutch under any temperature conditions likely to be encountered.

Pump unit reservoir (A) can be conveniently located. 2 or 3 strokes of handle disengages clutch. A turn of valve handle (B) engages clutch. A dual hydraulic jack unit (C) with ball bearing shift collar actuates the clutch. This (D) is the *Flex-Disc* Clutch.

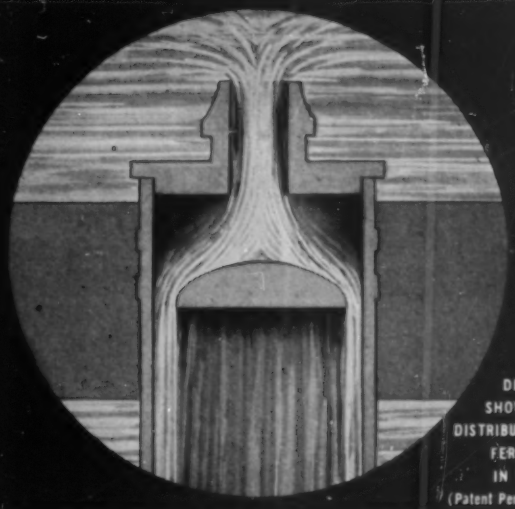
Tested in the field over 5 years on selected K-500 Compressors.

*Patents Pending

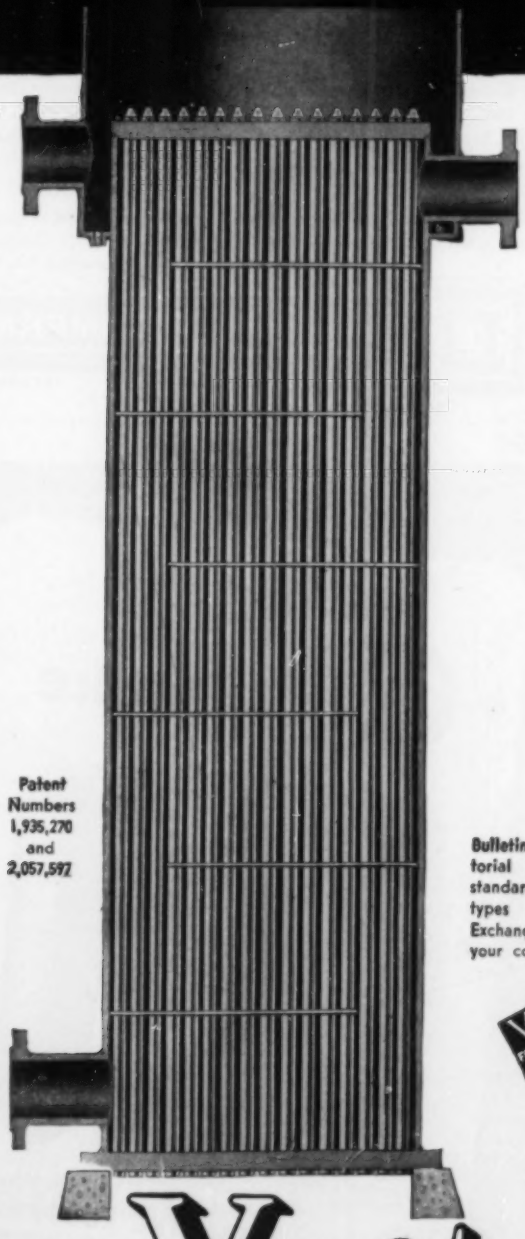
INDUSTRIAL CLUTCH CORPORATION

Waukesha Wisconsin

FILM TYPE EXCHANGERS



DETAIL SHOWING DISTRIBUTING FERRULE IN TUBE (Patent Pending)



Patent Numbers 1,935,270 and 2,057,592

Vogt engineers have taken a familiar refrigeration plant "old timer" and developed it into this modern, efficient heat exchanger.

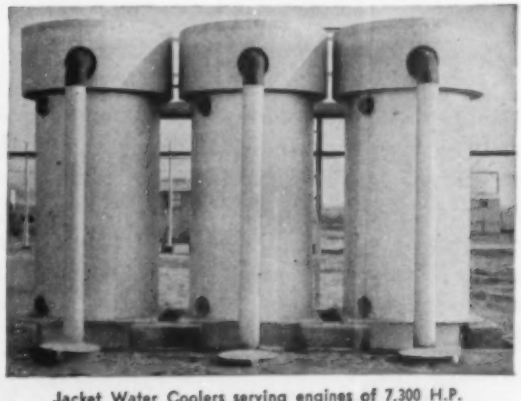
The film type exchanger operates in a vertical position. Water introduced in the top chamber is distributed in a thin film against the inner tube walls by means of special ferrules. The shell side of the exchanger has baffles arranged to provide optimum velocities, pressure drops, and heat transfer rates. Shutdowns are eliminated because tubes can be cleaned while the unit is in operation; thus permitting the use of dirty, mud and silt depositing water.

Vogt Film Type Exchangers now serve as Jacket Water Coolers, Sulphuric Acid Coolers, and Sulphur Dioxide Condensers, and can be designed to condense any vapor. They are also applicable for handling liquids other than water in film flow.

HENRY VOGT MACHINE CO., INC.
LOUISVILLE 10, KENTUCKY

Branch Offices: New York, Philadelphia, Cleveland, Chicago, St. Louis, Dallas

Bulletin HE-5 is a pictorial presentation of standard and special types of Vogt Heat Exchangers. Write for your copy.



Jacket Water Coolers serving engines of 7,300 H.P. Muddy well water used as cooling medium.

Vogt

HEAT TRANSFER EQUIPMENT

DEPENDABLE PNEUMATIC SERVICE

WHEN EQUIPMENT IS PROTECTED BY

DRIAIR

A COMPLETE SELF-CONTAINED UNIT

DriAir may be installed by suspending it from the piping, without any other support, or may stand on the floor near equipment being protected

DRIAIR speeds production by separating and automatically ejecting the condensed water and oil from the air. DriAir collects dirt and rust from the air lines and delivers clean dry air to the tools, thus reducing wear and prolonging their life. All internal parts are made of bronze or copper – resistant to corrosion and practically permanent. Copy of Bulletin DA fully describing the operation of DriAir sent on request.

NEW JERSEY METER COMPANY

PLAINFIELD, NEW JERSEY

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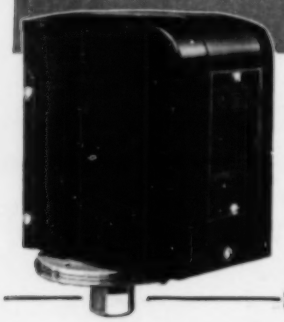
for AIR COMPRESSORS *and* WATER PUMPS



Class 9013
type ASG

PRESSURE SWITCH

250 lbs. pressure limit
10 to 50 lbs. differential

• A standard controller for motor-driven air compressors and water pumps. Heavy contacts with silver permanently bonded to the heavy bronze backing. Generous electrical ratings. Four ⅞ inch knockouts for ½ inch conduit are provided for convenient wiring.

Modern blue-grey enameled steel cover. Corrosion-resisting inner parts. High-grade impregnated fabric diaphragm. Oil-resisting type also available.

Write for Bulletin • illustrations, specifications of Square D pressure switches and related devices. Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wis.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

BURGESS SNUBBERS · BURGESS SNUBBERS

ASSURANCE OF A

• Quiet intake

Don't put up with troublesome pumping noise at the intake of your compressor or blower, or the discharge from a vacuum pump. Install the correct size Burgess Snubber and eliminate the noise problem easily.

When you eliminate noise, you may also improve compressor operation, because a Burgess Snubber eliminates tuning pipe length to obtain best efficiency. It smooths the flow of air without choking or restricting air flow.

P.S. A Burgess-Manning Combination Air Intake Cleaner - Snubber is also available for air cleaning plus quieting. Write for full information.

BURGESS-MANNING COMPANY
749-P EAST PARK AVE., LIBERTYVILLE, ILLINOIS

BURGESS SNUBBERS · BURGESS SNUBBERS

Get it from CRANE . . .
for quality in every piping item

It's as simple as that! *Everything* from Crane is the easy way to specify "Quality" in all piping equipment. Whether it's valves, fittings, accessories or fabricated piping . . . one catalog and one order quickly bring everything you need from your nearest Crane Branch.

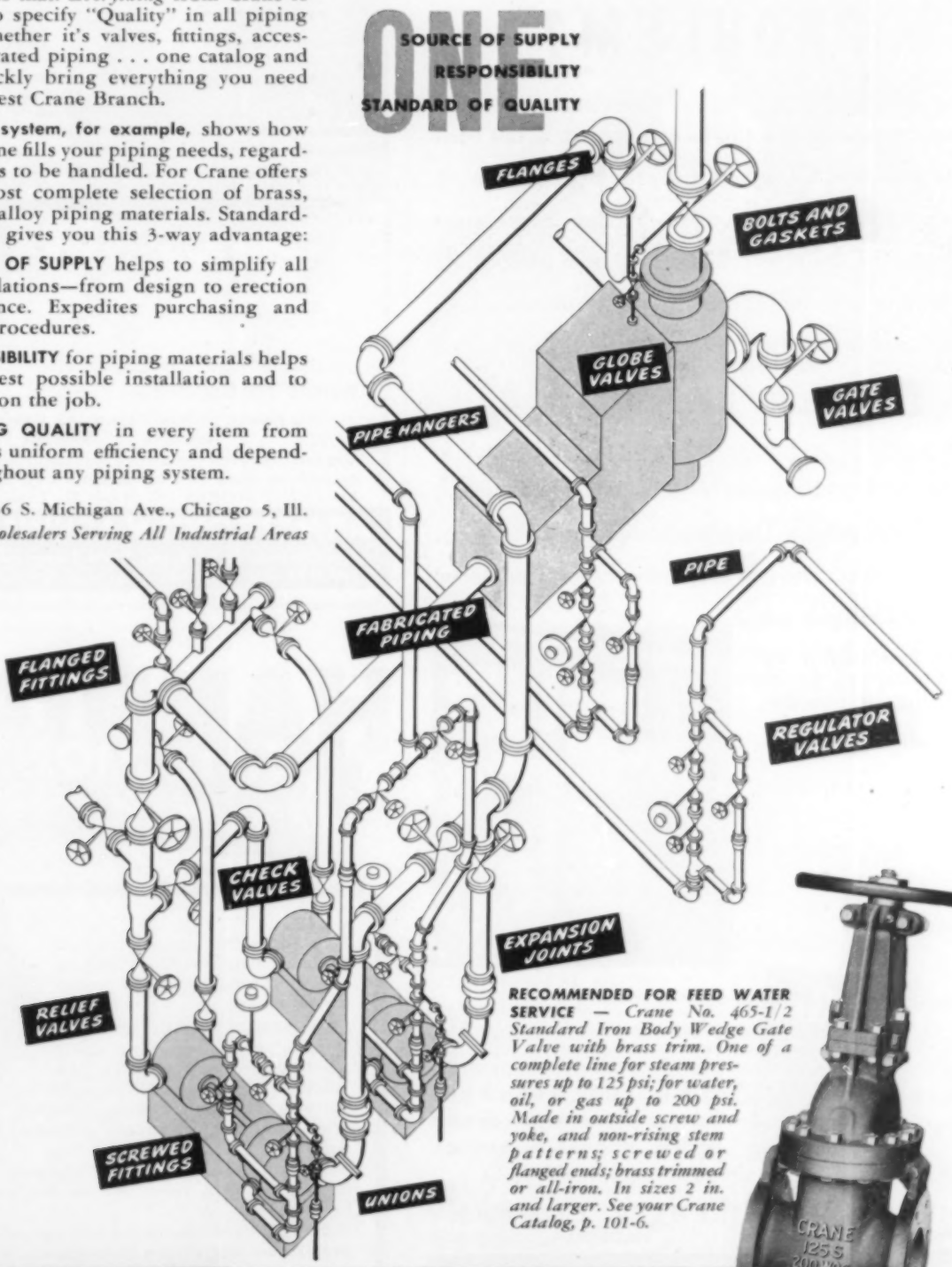
This boiler feed system, for example, shows how completely Crane fills your piping needs, regardless of the fluids to be handled. For Crane offers the world's most complete selection of brass, iron, steel and alloy piping materials. Standardizing on Crane gives you this 3-way advantage:

ONE SOURCE OF SUPPLY helps to simplify all piping installations—from design to erection to maintenance. Expedites purchasing and store-room procedures.

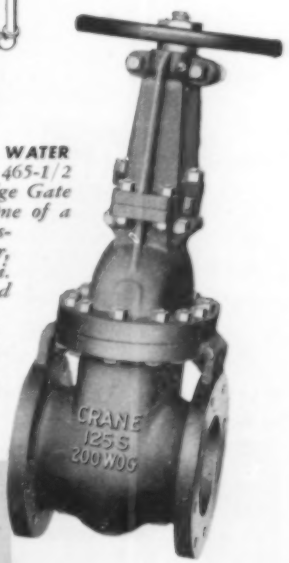
ONE RESPONSIBILITY for piping materials helps to get the best possible installation and to avoid delays on the job.

OUTSTANDING QUALITY in every item from Crane assures uniform efficiency and dependability throughout any piping system.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



RECOMMENDED FOR FEED WATER SERVICE — *Crane No. 465-1/2 Standard Iron Body Wedge Gate Valve with brass trim. One of a complete line for steam pressures up to 125 psi; for water, oil, or gas up to 200 psi. Made in outside screw and yoke, and non-rising stem patterns; screwed or flanged ends; brass trimmed or all-iron. In sizes 2 in. and larger. See your Crane Catalog, p. 101-6.*



EVERYTHING FROM . . .

VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

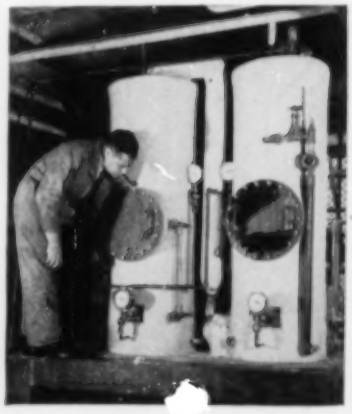
CRANE

FOR EVERY PIPING SYSTEM

HAVE YOU A FRESH WATER PROBLEM?

Any evaporator can produce fresh water, but what you want is efficiency. Scaling, the big headache, is reduced to a minimum in Maxim Evaporators because of their very high circulation rate. When descaling is necessary a unique design feature allows quick and easy descaling, cutting down time by hours.

Maxim Evaporators are extremely compact . . . automatic in operation, and produce fresh water to a purity of 2/10 grains of solid per gallon, or 3½ parts per million. They are available in single or double effect. The two evaporators shown produced on test 2500 gals. per day and higher capacities are possible. Investigate these very efficient evaporator units.



SEND FOR BULLETI

Eight pages of information, detailed drawings, diagrammatic hook-ups, single and double effect.

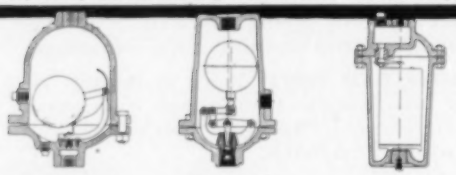
THE MAXIM SILENCER COMPANY
61 HOMESTEAD AVE. HARTFORD 1, CONNECTICUT

BE SURE IT'S A MAXIM

HOW TO SELECT A TRAP FOR AUTOMATIC DRAINAGE OF COMPRESSED AIR SYSTEMS

Type of Trap	Inverted Bucket	Snap Action	Regular Ball Float
Handles oil	Very well*	Light oil only	No
Handles dirt	Very well	Moderate	No
Air Loss	Small	None	None
Requires Priming	Yes	No	No
Float collapse or leakage	Impossible	Remote	Remote

*For very heavy oil use nothing smaller than No. 213 trap.



No. 71 Snap Action Air Trap — No. 2 Ball Float Trap — Inverted Bucket Trap

WHERE TO USE THEM

Drip Points . . . After Coolers . . . Intercoolers . . . Separators . . . Receivers

Get full details on Armstrong automatic drainage of compressed air lines. Ask for Bulletin 143. ARMSTRONG MACHINE WORKS, 885 Maple St., Three Rivers, Mich.

ARMSTRONG MACHINE WORKS
Manufacturers of Air Traps, Steam Traps, Steam Humidifiers and High Side Floats and Purgers for Refrigeration Systems.

HANNIFIN

PROTECTION for air operated equipment

HERE is the new air pressure regulator that gives you everything you want for control and protection of air operated equipment.

NO DANGER OF PRESSURE BUILD-UP. Thanks to the automatic safety relief feature of Hannifin's "Air Warden" valve design. No pressure build-up above setting of regulator even if valve is accidentally prevented from seating tight.

SAVES AIR. Easy to "back off" pressure without exhausting control valve. No air lost except excess pressure.

PRECISION CONTROL. Instrument type adjusting knob. Precision construction throughout. Write for the full story.

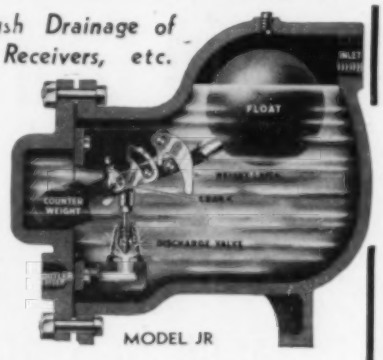
HANNIFIN CORPORATION
1101 S. Kilbourn Avenue Chicago 24, Illinois

HANNIFIN AIR WARDEN REGULATOR

LARGE CAPACITIES of Nicholson Traps

PREVENT FOUL AIR LINES

Due to Sluggish Drainage of Aftercoolers, Receivers, etc.



MODEL JR

Among the features of Nicholson weight-operated traps is the non-wire-drawing valve, which opens wide instantaneously to discharge, after which it closes tight—instantaneously. The attendant extra-large drainage capacity together with their ruggedness and leak-proof valve increasingly recommend Nicholson air traps where dependable drainage of water, oil and dirt, in possible volume, is a "must". Types for all applications, and for pressures to 1500 lbs. CATALOG 448

W. H. NICHOLSON & CO. 180 OREGON STREET WILKES-BARRE, PA.

Valves ★ Traps ★ Steam Specialties

GET A HEAD START
No matter what your job is, you can't afford to let your neighbor beat you to the gun.
Whether you're an artist, office worker, designer or technician, you want the best—and the best means KOH-I-NOOR.
When you work with a fine, smooth, KOH-I-NOOR Drawing Pencil, the advantage is all yours, because you know that KOH-I-NOOR is the Right Pencil for your Job!
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The RIGHT Pencil For Your Job

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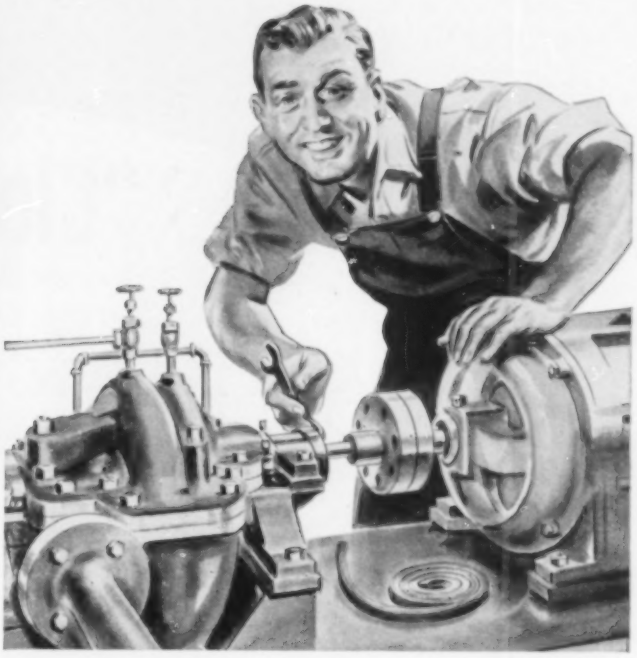
The RIGHT pencil for the RIGHT job

KOH-I-NOOR PENCIL COMPANY, INC., BLOOMSBURY, NEW JERSEY



NOW THIS PUMP IS PACKED

—and Packed Right!

When you pack your centrifugal or rotary pumps with Garlock packing you can be satisfied that they are packed with the highest grade materials. Some of the most widely used Garlock braided asbestos packings for rotating shafts are:

FOR WATER

GARLOCK 730 or 733 patented Lattice-Braid
GARLOCK 234 Square braid
GARLOCK 244 Square braid—wire inserted yarn
GARLOCK 644 Square braid—with lead strands

FOR OIL OR GASOLINE

GARLOCK 237 Square braid
GARLOCK 732 patented Lattice-Braid—with wire

FOR MINERAL ACIDS

GARLOCK 736 patented Lattice-Braid—blue asbestos
GARLOCK 230 Square braid—blue asbestos

No matter what you require in the way of a pump packing, Garlock makes it. Let the Garlock representative survey your pumps and make recommendations.

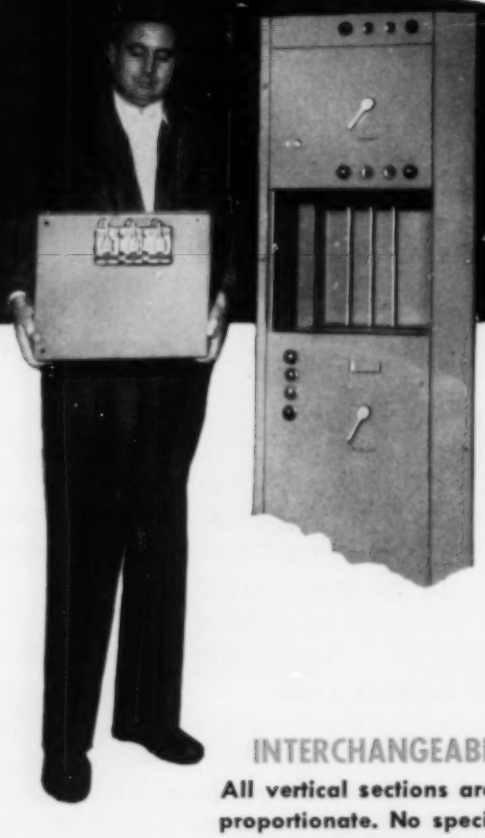
THE GARLOCK PACKING COMPANY
PALMYRA, N. Y.
In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

GARLOCK

"Clothespin Contact"...

in the new G-E Motor Control Center

marks new advance in starter design



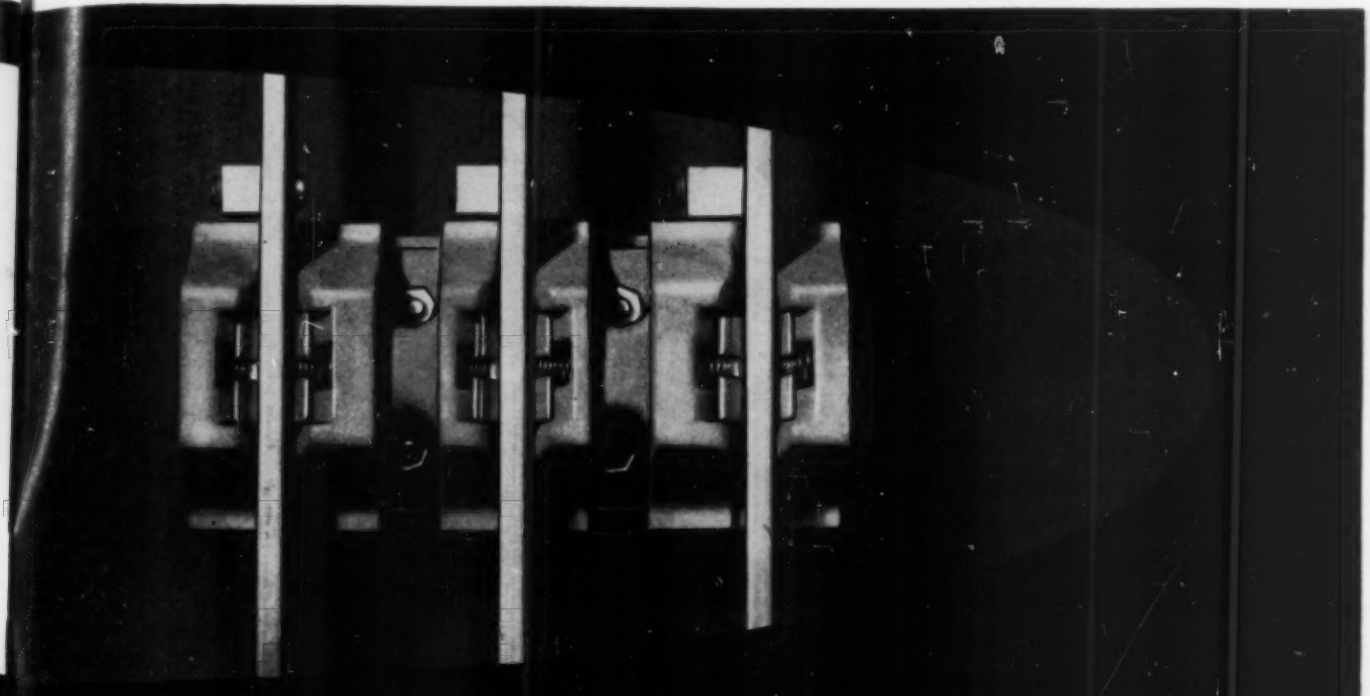
No wiring from starter to bus necessary with this new feature. Simply put the starter in place . . . . and the stabs automatically engage the bus bars in quick, positive connec-

SAVES SPACE **This compact centralized motor control system permits you to put all of your control in one spot—simplifies installation, interconnections, and maintenance. Control centers are only 12 inches deep, all wiring is front-connected so units may be placed back to back, in an "L" shape or flush against the wall.**

INTERCHANGEABLE

All vertical sections are the same size, all starter units are proportionate. No special engineering is necessary to plan your own G-E control center. To make it even simpler—starter units for motors from 1 to 25 horsepower have the same overall dimensions.

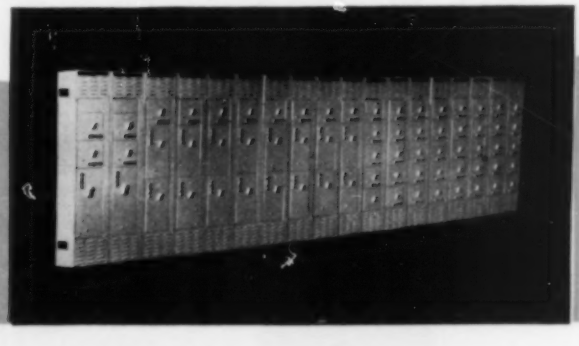
GENERAL ELECTRIC

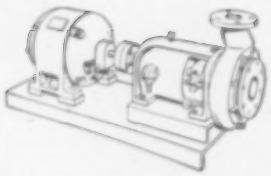


tion. For emergency handling, the starter can be removed without de-energizing the power bus after a simple removal of the supporting bolts.

PLAN YOUR OWN G-E MOTOR CONTROL CENTER

Contact our sales engineer at the nearest G-E office for copies of an easy-to-use planning chart—or write us for bulletin GEA-4979 which contains additional information. ***Apparatus Dept., Section 676-263, General Electric Company, Schenectady, New York.***





3 Reasons why I-R Chemical Pumps will give you Better Service

1

They are ARMORED AGAINST CORROSION —with IRCAMET

Ingersoll-Rand chemical pumps are built to stand up under the continuous handling of corrosive and abrasive liquids. All parts of the pump that come in contact with the liquid are made of IRCAMET—a high nickel-chromium-molybdenum alloy steel developed exclusively by I-R for chemical pump service. Laboratory tests and years of field experience have proved its exceptional ability to resist the corrosive action of a wide variety of acids and alkalis. Other materials are available for special operating conditions. The entire unit is further protected against corrosion by special paint which is highly resistant to chemical action.

2

They are PROTECTED AGAINST LEAKAGE —with the LEAKOLLECTOR

The patented LEAKOLLECTOR stuffing-box gland—an exclusive feature of all I-R chemical pumps—provides a simple and effective solution to the problem of pump leakage.

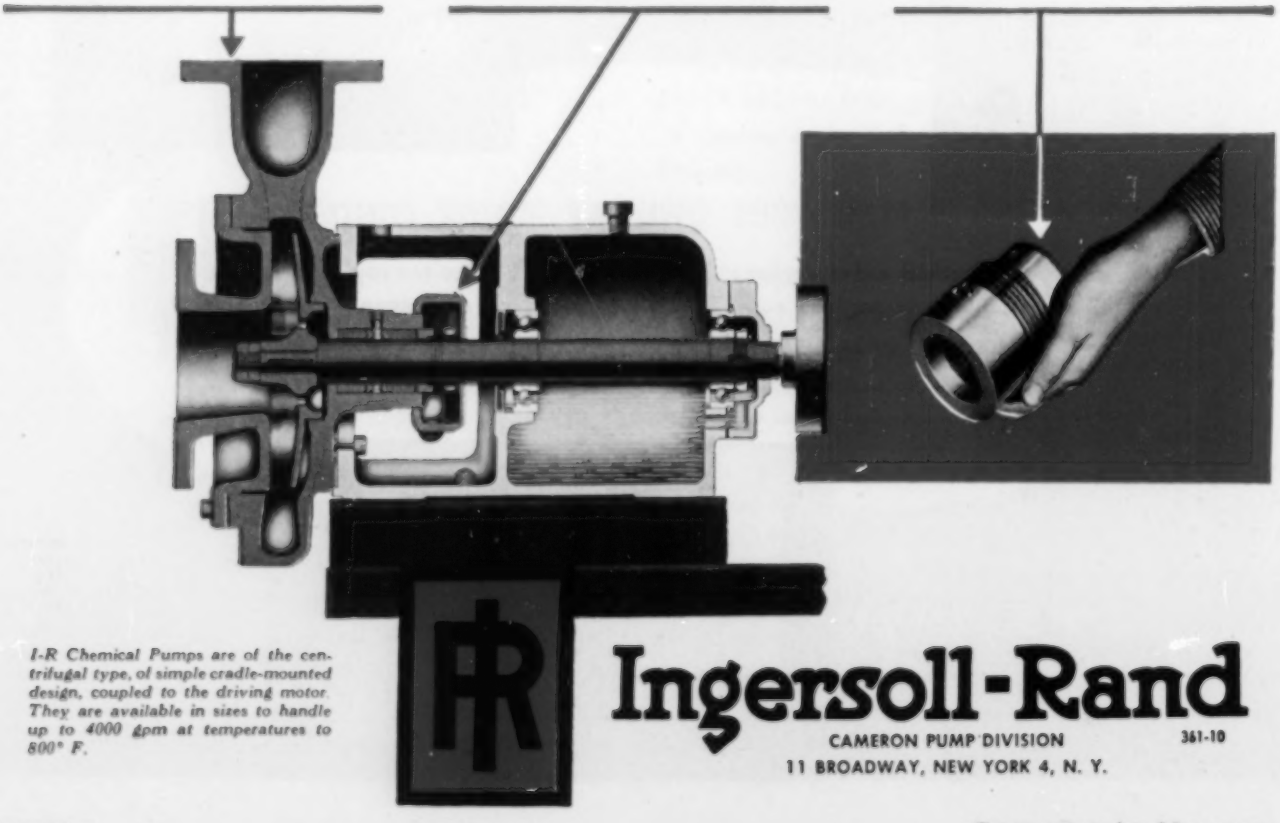
It completely encircles the stuffing box, trapping all leakage so that it can be drained away for collection or disposal. The split gland is accurately fitted to both the inside and outside of the box, and will catch any seepage escaping between the shaft and packing, or between the packing and the bore of the box. The LEAKOLLECTOR is easily removed from the shaft for repacking the box.

3

They are BUILT FOR EASY MAINTENANCE —and LESS OF IT

These pumps are ruggedly constructed to last longer on the job—and the simple design, with all parts easily accessible, means less "time out" for maintenance. The short, rigid stainless-steel shaft prevents impeller whip and eliminates many stuffing box troubles. The suction nozzle is removable, permitting access to the impeller without disturbing the discharge piping.

THE CAMERON SHAFT SEAL can be installed on all I-R chemical pumps to replace the conventional stuffing-box packing. It eliminates stuffing-box leakage and requires practically no attention or maintenance.

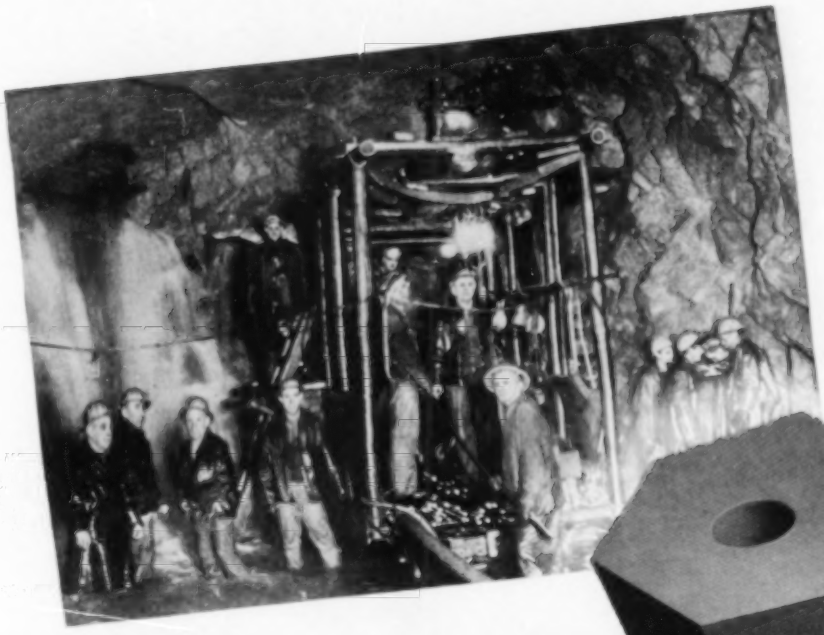


I-R Chemical Pumps are of the centrifugal type, of simple cradle-mounted design, coupled to the driving motor. They are available in sizes to handle up to 4000 gpm at temperatures to 800° F.

Ingersoll-Rand

CAMERON PUMP DIVISION 361-10

11 BROADWAY, NEW YORK 4, N. Y.



CHARACTER
is
what counts
in
drill steel

CRUCIBLE

Hollow drill steel has CHARACTER

It's better to buy drill steel with character and reliability as you need speed and consistently low drilling costs. Crucible character in drill steel is something that is established by the experience of thousands of users. Its constant quality performance for these customers is the cumulative proof that this drill steel is giving them profitable results. That's the kind of reputation Crucible's Hollow Drill Steel has earned in construction, mining and quarrying during the past half century.

More rock drilled for less money

Prior to shipment, every lot of Crucible's Hollow Drill Steel is checked and tested for the following: Uniformity of analysis and structure; excellence of shank qualities; resistance to fatigue; concentricity of hole; stiffness; and accuracy of section. The result is drill steel that takes maximum punishment from modern drill equipment; drills more rock for less money . . . consistently.

You can get Crucible's Hollow Drill Steel in both carbon and alloy types . . . Crusca and "Park A" Alloy . . . in 3 shapes and all sizes. Your Crucible salesman can also supply you with alloy and Max-el machinery steels, high speed tool bits, alloy and carbon tool steels, and Rexweld hard surfacing welding rods. Crucible makes a full range of quality steels for industry.

3 shapes all sizes

Write for catalog on the steel best suited for your particular job.

"FULL-RANGE" QUALITY STEELS for INDUSTRY

CRUCIBLE STEEL Company of America

HIGH SPEED · TOOL · STAINLESS · ALLOY · MACHINERY · SPECIAL PURPOSE STEELS

Chrysler Building, 405 Lexington Ave., N. Y. 17, N. Y.

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AIR *without* WEAR

Ingersoll-Rand KA-315 Mobil-Air Compressors equipped with Timken bearings supplying air for rock drilling on an $11,000,000 water supply project in Michigan.

Ingersoll-Rand keeps down wear in their new KA-Series of portable air compressors by mounting the compressor crank shafts on Timken tapered roller bearings. At the same time they assure correct and permanent crank shaft alignment with full protection against radial, thrust and combined loads, simplify lubrication and prolong compressor life. Timken bearings are also used in the wheels of these compressors.

If you are thinking of buying an anti-frictionized compressor of any type — portable or stationary — make sure of getting anti-friction advantages in full; specify Timken tapered roller bearings. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST →◫← LOADS OR ANY COMBINATION ✳